

REPORT NUMBER: 222-MGA-03-003

**SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 222
SCHOOL BUS PASSENGER SEATING AND CRASH PROTECTION**

**Mid Bus Inc.
2003 Mid Bus Guide School Bus
NHTSA No.: C30903**

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105**

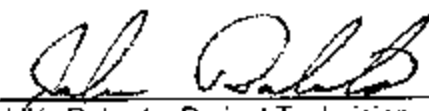


Final Report Date: September 30, 2003

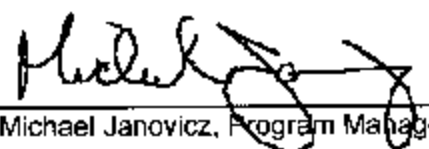
FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Technical Report Documentation Page

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16. Abstract Compliance tests were conducted on the subject 2003 Mid Bus Guide School Bus, NHTSA No. C30903 in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-222-03 for the determination of FMVSS 222 compliance.					
Notes: 1. The forward deflection of the B1 retraining barrier exceeded the maximum allowable force of 10,675 N before reaching the 356 mm displacement. Actual total force reached 14,091.9 N at 204 mm displacement. 2. Seat S3 failed to meet energy requirement of 948 joules when deflected 254 mm. The actual energy totaled 837.6 joules. 3. Seat S9 failed to meet energy requirement of 1356 joules when deflected 356 mm. The actual energy totaled 1304.6 joules. 4. The force application to the W5 wheelchair anchorage point (type C) did not reach 26,688 N before the failure of the floor structure. The actual force was 13104 N before failure of the floor structure. 5. The plotted force vs. deflection data from the forward deflection of the B9 retraining barrier failed to remain within the specified corridor found in 49 CFR 571.222 Figure 1. 6. The forward projection of each seat back aft of each restraining barrier (as required in 49 CFR 571.222) falls outside the perimeter of the restraining barriers.					
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SECTION 1
PURPOSE OF COMPLIANCE TEST

Tests were conducted on a MY2003 Mid Bus Guide School Bus, NHTSA No. C30903, in accordance with the specifications of the Office of Vehicle Safety Compliance (OVSC) Test Procedures TP-222-03 to determine compliance to the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 222, "School Bus Passenger Seating and Crash Protection".

This program is sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-02-D-01057.

SECTION 2

TEST DATA SUMMARY

The passenger seating and crash protection tests were conducted during June 2003. The test vehicle, MY2003 Mid Bus Guide School Bus, NHTSA No. C30903, does not meet all the requirements of FMVSS 222. All tests were conducted by MGA Research Corporation at the Wisconsin Operations.

LINEAR AND AREA MEASUREMENTS

Seat to seat/barrier spacing was checked on all seats and found to be 610 mm or less as shown on Data Sheet 1.

The seat back height and front surface area of Seat Nos. 1 and 9 were measured in accordance with Section 12.1 of OVSC TP-222-03. As shown in Data Sheet 2 for Seat Nos: 1 and 9, the seat back area is greater than ninety percent of the seat bench width multiplied by 508.

Restraining barrier position and projected rear surface area of Barrier Nos. 1 and 9 were measured in accordance with OVSC TP-222-03. As shown in Data Sheet 6 for Barrier Nos: 1 and 9, the projected surface of the barriers are not equal to or greater than the seat backs to the rear of them.

SEAT CUSHION RETENTION

Seat No. 1 was tested in accordance with Section 12.3 of OVSC TP-222-03. Seat cushion weight was 4.5 kg. The maximum forces for Seat Cushion No. 1 was 220 N. The lower time limit boundary (t1) was approximately 4 seconds with an approximate load duration of 5 seconds. As shown in Data Sheet 3, the seat cushions tested complied with all requirements.

SECTION 2 (CONTINUED)

TEST DATA SUMMARY

SEAT BACK FORCE/DEFLECTION TEST - FORWARD

Seat Nos. S6, S7 and S9 were tested in accordance with Section 12.4 of OVSC TP-222-03. Seat bench width was determined to be 995 mm. "W" was calculated to be 2.6 and rounded to the nearest whole number (3). The seating reference point (SRP) was 475 mm above the bus floor. The deflection of the seat back at conclusion of lower loading bar loading at 4674 N position was 75 mm on Seat No. 6, 75 mm on Seat No. 7, and 82 mm on Seat No. 9. The allowable maximum deflection without moving the seat back to within 102 mm of another seat or restraining barrier was 356 mm on all three seats. The stroke rate of the upper loading bar was determined by the test engineer to be 14.4 mm/sec for both seats. The location of the upper loading bar was 406 mm above the SRP. The energy under the force and deflection curve of the upper loading bar was 1627 joules for Seat No. 6, 1331 joules for Seat No. 7, and 1304 joules for Seat No. 9. The minimum energy as indicated by the required area under the force versus deflection curve of the upper loading bar was 452 W or 1356 joules. As shown on Data Sheet No. 4, Seat No. 6 met the force deflection forward energy requirements. Seat Nos. 7 and 9 did not meet the force deflection forward requirements. See Plot No. 2 for Seat No. 6, Plot No. 4 for Seat No. 7, and Plot No. 6 for Seat No. 9. It also should be noted that Seat No. 7 was removed and tested in the Seat No. 8 location.

SEAT BACK FORCE/DEFLECTION TEST - REARWARD

Seat Nos. 2 and 3 were tested in accordance with Section 12.4 of OVSC TP-222-03. Seat bench width was determined to be 995 mm for Seat No. 2 and 995 mm for Seat No. 3. "W" was calculated to be 2.6 and rounded to the nearest whole number (3). The seating reference point (SRP) was 475 mm above the bus floor. The allowable maximum deflection without moving the seat back to within 102 mm of another seat or restraining barrier was 254 mm. The stroke rate of the upper loading bar was determined by the test engineer to be 10.6 mm/sec for Seat Nos. 2 and 3. The location of the loading bar was 343 mm above the SRP for both Seat Nos. 2 and 3. The test was stopped when the maximum deflection of the seat back of 254 mm was achieved. It should also be noted that Seat No. 2 was removed and tested in the Seat No. 3 location.

SECTION 2 (CONTINUED)

TEST DATA SUMMARY

SEAT BACK FORCE/DEFLECTION TEST – REARWARD (CONTINUED)

The area under the force versus deflection curve of the loading bar was 856 joules for Seat No. 2 and 837 joules for Seat No. 3. The minimum required area under the force versus deflection curve of the loading bar was 316 W or 948 joules. As shown in Data Sheet No. 5, the energy under the force versus deflection curve for the loading bar failed to meet the minimum required energy for both Seat Nos. 2 and 3. See Plots 8 and 9.

RESTRAINING BARRIER FORCE/DEFLECTION TEST - FORWARD

The right mid restraining barrier (B9) and the left restraining barrier (B1) were tested in accordance with Section 12.4 of OVSC TP-222-03. Seat bench width was determined to be 995 mm. "W" was calculated to be 2.6 and rounded to the nearest whole number (3). The SRP was 475 mm above the bus floor. The lower loading bar was 475 mm above the bus floor. The deflection of the restraining barrier at the conclusion of the lower loading bar loading at 4662 N (1554 W) was 123 mm on B9 and 116 mm on B1. The allowable maximum deflection without moving the restraining barrier to within interference of a seat or door was 356 mm. The stroke rate of the upper loading bar was determined by the test engineer from test data to be 14.4 mm/sec. The location of the upper loading bar was 406 mm above the SRP. The test for B9 was stopped when the maximum deflection of 356 mm was reached. The area under the force versus deflection curve for B9 was 1473 joules, as shown on Data Sheet 10. The minimum required area under the force versus deflection curve of the upper loading bar is 452 W or 1356 joules. Note that the force deflection curve falls outside of the corridor, thus denoting a failure for B9. The test for B1 was stopped when the force exceeded the upper limits of the force versus deflection corridor as shown on Data Sheet 12.

HEAD FORM IMPACT ZONE TESTS

Seat No. 1 and the wall above and behind the driver were tested in accordance with Section 12.6 of OVSC TP-222-03. The mass of the head form was 5.20 kg. All head form contact area and impact energy criteria were met for the seat.

SECTION 2 (CONTINUED)

TEST DATA SUMMARY

KNEE FORM IMPACT ZONE TESTS

Seat No. 1 was tested in accordance with Section 12.7 of OVSC TP-222-03. The mass of the knee form was 4.52 kg. All knee form contact area criteria and impact energy criteria were met for the seat.

WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES

Securement anchorage for wheelchair location W5 was tested in accordance with Appendix 3 of OVSC TP-222-03. Wheelchair location W5 is located as shown in the seating diagram in Section 8 and designed for forward facing occupants.

Anchorage attachments and webbing straps provided with the vehicle were used to conduct the tests. The Type AB Anchor Point failed to meet the required load of 26,688 N before the failure of the floor structure at 13,104 N. See Data Sheet 38. The Type D Upper Torso Restraint met the requirements for static loading of 6,272 N. Actual load was 7,832 N. See Data Sheet 39.

ADMINISTRATIVE DATA SHEET

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

INCOMPLETE VEHICLE (IF APPLICABLE)

Manufacturer:	
Model:	
VIN:	
Build Date:	
Certification Date:	

COMPLETED VEHICLE (SCHOOL BUS)

Manufacturer:	Mid Bus Inc.
Make/Model:	2003 Mid Bus Guide
VIN:	1GBJG31U431110295
NHTSA No.:	C30903
Color:	Yellow
GVWR:	5443 kg
Build Date:	9/02
Certification Date:	12/02

DATES

Vehicle Receipt:	April 17, 2003
Start of Compliance Test:	June 9, 2003
Completion of Compliance Test:	June 24, 2003

TEST VEHICLE (SCHOOL BUS) DISPOSITION: **FMVSS 301S Test**

COMPLIANCE TEST:

All tests were performed in accordance with the references outlined in TP-222-03.

Recorded By: 

Approved By: 

Date: September 30, 2003

GENERAL TEST DATA SHEET

Test Vehicle: **2003 Mid Bus Gulde School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
 Test Date: **6/11/03**

SCHOOL BUS IDENTIFICATION

Model Year/Mfr./Make/Model:	2003 Mid Bus Guide
Wheelbase:	meters
Passenger Capacity:	25 (1 driver, 24 passengers, 1 wheelchair)
NHTSA No.:	C30903
VIN:	1GBJG31U431110295
Conventional or Forward Control:	Conventional
GVWR (Certification Label) FRONT:	1951 kg
GVWR (Certification Label) REAR:	3901 kg
GVWR (Certification Label) TOTAL:	5443 kg

TEST CONDITIONS

Date(s) of Test:	8/9/03 – 6/24/03
Ambient Temperature (°C):	20
Required Temperature Range:	0°C to 32°C

SEAT IDENTIFICATION

Seat Manufacturer:	
Model Name & Number:	
Description of Seats:	Seat frames are constructed of 25.4 mm round welded steel tubing. The seat back has a .635 mm flat steel pan welded to the tubing and is covered with 25 mm poly foam on the front surface and 25 mm rebond foam on the outer edges and 35 mm molded Styrofoam blocks inset into the outboard knee impact areas. The seat cushion is constructed of 10 mm particle board with 125 mm tapering to 85 mm poly foam pad. The seat back and seat cushion are wrapped with .58 mm vinyl.

SECTION 3
COMPLIANCE TEST DATA

The following data sheets document the results of testing on the MY2003 Mid Bus Guide School Bus, NHTSA No. C30903.

DATA SHEET 1
SEAT TO SEAT/BARRIER SPACING

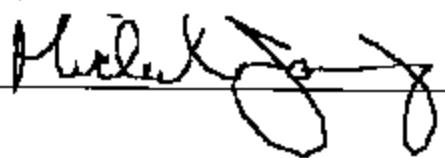
Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER	MEASUREMENT OF SPACING FROM SRP FORWARD TO SEAT/BARRIER (mm)	REQMT ≤ 610 MM ($\leq 24"$) CLASS 1 BUSES ONLY)
		PASS/FAIL
1	495	PASS
2	465	PASS
3	450	PASS
4	460	PASS
6	475	PASS
7	460	PASS
8	460	PASS
9	495	PASS

COMMENTS: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 2
SEAT BACK HEIGHT & FRONT SURFACE AREA TEST

Test Vehicle: **2003 Mid Bus Guide School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
 Test Date: **6/11/03**

SEAT NUMBER: S9

		PASS/FAIL
1.	Is the seat back height at least 508 mm vertically above the SRP? (S5.1.2)	PASS

2. Measure the seat back front projected area in a vertical plane bound by horizontal planes through the SRP and 508 mm above the SRP according to the following procedure:

Width, $a = 900$ mm; width, $b = 960$ mm; radius = 140 mm

Area = $\frac{1}{2}(a+b) \times 508$ mm = $472,440$ mm² - $\pi 8,330$ mm² = $464,110$ mm²

3. Measure the seat cushion width - $W1 = 995$ mm

If the seat cushion is not rectangular, measure the cushion at the forward most edge and the rearward most edge, average the widths, and use the average width as $W1$.

4. Calculate the following: $0.9 \times W1 \times 508$ mm = $454,914$ mm²

		PASS/FAIL
5.	Is item 2 greater than item 4? (S5.1.2)	PASS

NOTE: For a seat back or a seat cushion that has a nonsymmetrical shape or has a large radius at the corner, the above described measuring method must be modified as required to obtain accurate area measurements.

Comments: * Denotes area outside of radius.

Recorded By: _____

Approved By: _____

Date: September 30, 2003

DATA SHEET 2 (CONTINUED)
SEAT BACK HEIGHT & FRONT SURFACE AREA TEST

SEAT NUMBER: S1

		PASS/FAIL
1.	Is the seat back height at least 508 mm vertically above the SRP? (S5.1.2)	PASS

2. Measure the seat back front projected area in a vertical plane bound by horizontal planes through the SRP and 508 mm above the SRP according to the following procedure:

Width, $a = 900$ mm; width, $b = 960$ mm; radius = 140 mm

Area = $\frac{1}{2}(a+b) \times 508$ mm = $472,440$ mm² - $8,330$ mm² = $464,110$ mm²

3. Measure the seat cushion width - - $W1 = 995$ mm

If the seat cushion is not rectangular, measure the cushion at the forward most edge and the rearward most edge, average the widths, and use the average width as $W1$.

4. Calculate the following: $0.9 \times W1 \times 508$ mm = $454,914$ mm²

		PASS/FAIL
5.	Is item 2 greater than item 4? (S5.1.2)	PASS

NOTE: For a seat back or a seat cushion that has a nonsymmetrical shape or has a large radius at the corner, the above described measuring method must be modified as required to obtain accurate area measurements.

Comments: * Denotes area outside of radius.

Recorded By: John Rahl

Approved By: Michael J. [Signature]

Date: September 30, 2003

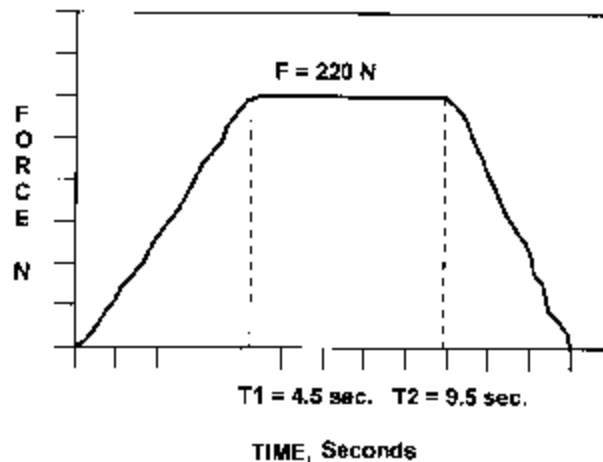
DATA SHEET 3
SEAT CUSHION RETENTION TEST

Test Vehicle: **2003 Mid Bus Guide School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
 Test Date: **6/11/03**

SEAT NUMBER: S1

1. Cushion Weight/Mass = 4.5 kg
2. Cushion Weight x 5 = F = 220 N (S5.1.5)
3. Complete the following force/time graph.



F must be 5 x Cushion Weight; t1 and t2 must be according to the following expressions:
 $T1 \geq 1 \text{ sec.}, < 5 \text{ sec.}, t2 = t1 + 5 \text{ sec.}, + 0 \text{ sec. and } -0.10 \text{ sec.}$

		PASS/FAIL
4.	Did seat cushion separate from the seat structure at any attachment point? (S5.1.5)	PASS

DESCRIBE SEAT CUSHION ATTACHMENTS: 2 half shell clamps on front of seat and 2 pivoting latch on rear.

Comments: NONE

Recorded By: John Rahls

Approved By: Michael [Signature]

Date: September 30, 2003

DATA SHEET 4
SEAT BACK FORCE DEFLECTION TEST - FORWARD

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/10/03**

SEAT NUMBER: S6

1. Seat Bench Width = 995 mm
 $W = (\text{Seat Bench Width})/381 \text{ mm (round to nearest whole number)} = (3)$
Seat Reference Point (SRP) location is: (Description of location as supplied by the manufacturer): 475 mm Above Floor, 268.2 mm back from front edge of seat
2. Location of lower loading bar is 0 mm above/below the SRP.
(Requirement: Between 102 mm above and 102 mm below the SRP) (S5.1.3.1)
Length of lower loading bar = 863.6 mm
Seat Back width at SRP = 972 mm
3. Include x-y plot of Force vs. Time for the lower loading bar.
4. Deflection of the seat back at conclusion of lower bar loading (1557 W Newtons position) = 75 mm, at start of upper bar loading 75 mm, at end of upper bar loading NR mm. (NR = Not Recorded)
5. Maximum deflection allowed without moving the seat back to within 102 mm of another seat or restraining barrier = 356 mm (must be 356 mm or less) (S5.1.3)
6. Seat back movement rate selected by the test engineer = 14.4 mmps
7. Location of upper loading bar is in a horizontal plane 406 mm above the SRP.
(Requirement: 406 mm) (S5.1.3.3). Length of upper loading bar = 762 mm Width of seat back at 406 mm above SRP = 881 mm
8. Reason for stopping seat back deflection:
☐ Reached deflection determined in Item 6 above (if less than 356 mm)
☒ Reached 356 mm maximum allowed deflection (Actual deflection was 349 mm)
☐ Separation was about to occur
9. Include the x-y plot of force vs. deflection for the upper loading bar with boundaries of Figure 14 (OVSC TP-222-3) superimposed.

DATA SHEET 4 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - FORWARD

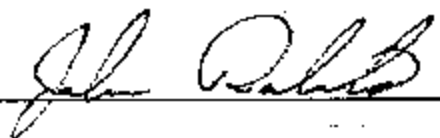
		PASS/FAIL
11.	Is the seat in its final deflected position within 102 mm of the next seat or barrier?	PASS

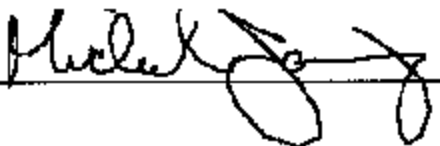
		PASS/FAIL
12.	Does the forward force vs. deflection trace of the seat back lie within the corridor? (S5.1.3)	PASS

- 13. Include a deflection vs. time plot for the upper loading bar.
- 14. The area within the force vs. deflection curve = 1627 joules
- 15. $452W = 1356$ joules (S5.1.3.4)

		PASS/FAIL
16.	Is item 14 greater than or equal to item 15? (S5.1.3.4)	PASS

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 4 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - FORWARD

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/20/03**

SEAT NUMBER: S7 (Tested in S8 Location)

1. Seat Bench Width = 995 mm
 $W = (\text{Seat Bench Width})/381 \text{ mm (round to nearest whole number)} = \{3\}$
2. Seat Reference Point (SRP) location is: (Description of location as supplied by the manufacturer): 475 mm Above Floor, 268.2 mm back from front edge of seat
3. Location of lower loading bar is 5 mm above the SRP.
(Requirement: Between 102 mm above and 102 mm below the SRP) (S5.1.3.1)
Length of lower loading bar = 863.6 mm
Seat Back width at SRP = 972 mm
4. Include x-y plot of Force vs. Time for the lower loading bar.
5. Deflection of the seat back at conclusion of lower bar loading (1557 W Newtons position) = 75 mm, at start of upper bar loading 75 mm, at end of upper bar loading NR mm. (NR = Not Recorded)
6. Maximum deflection allowed without moving the seat back to within 102 mm of another seat or restraining barrier = 356 mm (must be 356 mm or less) (S5.1.3)
7. Seat back movement rate selected by the test engineer = 14.4 mm/ps
8. Location of upper loading bar is in a horizontal plane 406 mm above the SRP.
(Requirement: 406 mm) (S5.1.3.3). Length of upper loading bar = 762 mm Width of seat back at 406 mm above SRP = 881 mm
9. Reason for stopping seat back deflection:
☐ Reached deflection determined in Item 6 above (if less than 356 mm)
☒ Reached 356 mm maximum allowed deflection (Actual deflection was 349 mm)
☐ Separation was about to occur
10. Include the x-y plot of force vs. deflection for the upper loading bar with boundaries of Figure 14 (OVSC TP-222-3) superimposed.

DATA SHEET 4 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - FORWARD

		PASS/FAIL
11.	Is the seat in its final deflected position within 102 mm of the next seat or barrier?	PASS

		PASS/FAIL
12.	Does the forward force vs. deflection trace of the seat back lie within the corridor? (S5.1.3)	PASS

- 13. Include a deflection vs. time plot for the upper loading bar.
- 14. The area within the force vs. deflection curve = 1331 joules
- 15. 452W = 1356 joules (S5.1.3.4)

		PASS/FAIL
16	Is item 14 greater than or equal to item 15? (S5.1.3.4)	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 4 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - FORWARD

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: S9

1. Seat Bench Width = 995 mm
 $W = (\text{Seat Bench Width})/381 \text{ mm (round to nearest whole number)} = (3)$
2. Seat Reference Point (SRP) location is: (Description of location as supplied by the manufacturer): 475 mm Above Floor, 268.2 mm back from front edge of seat
3. Location of lower loading bar is 0 mm above the SRP.
(Requirement: Between 102 mm above and 102 mm below the SRP) (S5.1.3.1)
Length of lower loading bar = 863.6 mm
Seat Back width at SRP = 972 mm
4. Include x-y plot of Force vs. Time for the lower loading bar.
5. Deflection of the seat back at conclusion of lower bar loading (1557 W Newtons position) = 82 mm, at start of upper bar loading 82 mm, at end of upper bar loading NR mm. (NR = Not Recorded)
6. Maximum deflection allowed without moving the seat back to within 102 mm of another seat or restraining barrier = 356 mm (must be 356 mm or less) (S5.1.3)
7. Seat back movement rate selected by the test engineer = 14.4 mm/ps
8. Location of upper loading bar is in a horizontal plane 406 mm above the SRP.
(Requirement: 406 mm) (S5.1.3.3). Length of upper loading bar = 762 mm Width of seat back at 406 mm above SRP = 881 mm
9. Reason for stopping seat back deflection:
☐ Reached deflection determined in Item 6 above (if less than 356 mm)
☒ Reached 356 mm maximum allowed deflection (Actual deflection was 349 mm)
☐ Separation was about to occur
10. Include the x-y plot of force vs. deflection for the upper loading bar with boundaries of Figure 14 (OVSC TP-222-3) superimposed.

DATA SHEET 4 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - FORWARD

		PASS/FAIL
11.	Is the seat in its final deflected position within 102 mm of the next seat or barrier?	PASS

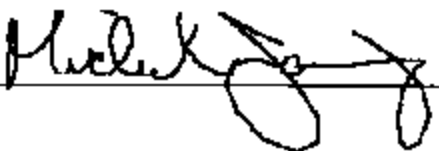
		PASS/FAIL
12.	Does the forward force vs. deflection trace of the seat back lie within the corridor? (S5.1.3)	PASS

13. Include a deflection vs. time plot for the upper loading bar.
 14. The area within the force vs. deflection curve = 1304 joules
 15. 452W = 1356 joules (S5.1.3.4)

		PASS/FAIL
16	Is item 14 greater than or equal to item 15? (S5.1.3.4)	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 5
SEAT BACK FORCE DEFLECTION TEST - REARWARD

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: S2 (Tested in S3 Location)

1. Seat Bench Width = 995 mm
 $W = (\text{Seat Bench Width})/381 \text{ mm (round to nearest whole number)} = (3)$
2. Location of the loading bar is in a horizontal plane 343 mm above the SRP of the test seat. (Requirement: 343 mm above the SRP) (S5.1.4.1)
Length of loading bar = 762 mm
Width of seat back at 343 mm above SRP = 876 mm
3. Deflection of seat back at 222 N preload = Not Recorded
4. Maximum deflection allowed without moving the seat back to within 102 mm of another seat = 254 mm (maximum allowed = 254 mm) (S5.1.4)
5. Seat back movement rate selected by the test engineer = 14.4 mm/sec
6. Reason for stopping deflection:
☐ Reached deflection determined in Item 4 above (if less than 254 mm)
☒ Reached 254 mm maximum allowed deflection (Actual deflection was 251 mm)
☐ Separation was about to occur
7. Include the x-y plot of force vs. deflection for the loading bar with boundaries of Figure 18 (OVSC TP-222-3) superimposed.

		PASS/FAIL
8.	Does the force vs. deflection plot lie within the boundaries of Figure 18 (OVSC TP-222-03)?	PASS

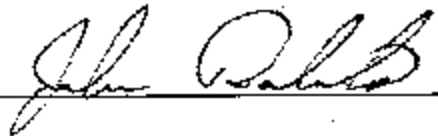
9. Include a deflection vs. time plot for the upper loading bar.
10. 316W = 948 joules
11. The area within the force vs. deflection curve = 856 joules

DATA SHEET 5 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST – REARWARD

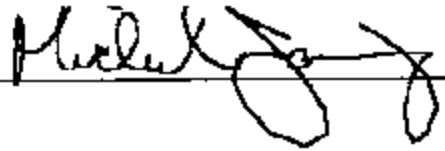
		PASS/FAIL
12.	Is item 11 greater than or equal to item 10? (S5.1.4.2)	FAIL

Comments: NONE

Recorded By:



Approved By:



Date: September 30, 2003

DATA SHEET 5 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST - REARWARD

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: S3

1. Seat Bench Width = 995 mm
 $W = (\text{Seat Bench Width})/381 \text{ mm (round to nearest whole number)} = (3)$
2. Location of the loading bar is in a horizontal plane 343 mm above the SRP of the test seat. (Requirement: 343 mm above the SRP) (S5.1.4.1)
Length of loading bar = 762 mm
Width of seat back at 343 mm above SRP = 876 mm
3. Deflection of seat back at 222 N preload = Not Recorded
4. Maximum deflection allowed without moving the seat back to within 102 mm of another seat = 254 mm (maximum allowed = 254 mm) (S5.1.4)
5. Seat back movement rate selected by the test engineer = 14.4 mm/sec
6. Reason for stopping deflection:
☐ Reached deflection determined in Item 4 above (if less than 254 mm)
☒ Reached 254 mm maximum allowed deflection (Actual deflection was 251 mm)
☐ Separation was about to occur
7. Include the x-y plot of force vs. deflection for the loading bar with boundaries of Figure 18 (OVSC TP-222-3) superimposed.

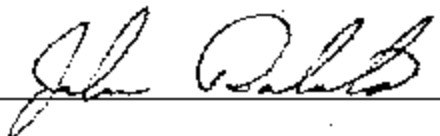
		PASS/FAIL
8.	Does the force vs. deflection plot lie within the boundaries of Figure 18 (OVSC TP-222-03)?	PASS

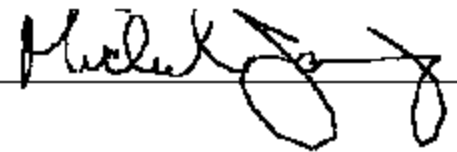
9. Include a deflection vs. time plot for the upper loading bar.
10. $316W = 948 \text{ joules}$
11. The area within the force vs. deflection curve = 837 joules

DATA SHEET 5 (CONTINUED)
SEAT BACK FORCE DEFLECTION TEST – REARWARD

		PASS/FAIL
12.	Is item 11 greater than or equal to item 10? (S5.1.4.2)	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 6

RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

BARRIER NUMBER: B1

See Figure 9 from OVSC TP-222-03 for diagram.

1. Measure distance T from SRP of seat immediately aft of barrier in a horizontal longitudinal line forward to barrier. T = 495 mm

		PASS/FAIL
2.	Is distance T equal to or less than 610 mm? (S5.2)	PASS

3. Measure distance D at top (t) and bottom (b) of barrier.

$D_t = 36$ mm $D_b = 19$ mm

4. Measure distance C at top (t) and bottom (b) of seat.

$C_t = 60$ mm $C_b = 14$ mm

		PASS/FAIL
5.	Is D_t equal to or less than C_t ?	PASS

		PASS/FAIL
6.	Is D_b equal to or less than C_b ?	FAIL

7. Measure distance E at top of barrier and bottom of barrier.

$E_t = 865$ mm $E_b = 952$ mm

8. Measure distance A at top of seat back and bottom of seat.

$A_t = 876$ mm $A_b = 960$ mm

DATA SHEET 6 (CONTINUED)

RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

		PASS/FAIL
9.	Is distance $E_i + D_i$ equal to or greater than distance $A_i + C_i$?	FAIL

		PASS/FAIL
10.	Is distance $E_o + D_o$ equal to or greater than distance $A_o + C_o$?	FAIL

11. Measure distance U at inboard (i) and outboard (o) side of barrier.

$U_i = 332 \text{ mm}$

$U_o = 332 \text{ mm}$

12. Measure distance V at inboard (i) and outboard (o) sides of seat.

$V_i = 325 \text{ mm}$

$V_o = 355 \text{ mm}$

		PASS/FAIL
13.	Is U_i equal to or less than V_i ?	FAIL

		PASS/FAIL
14.	Is U_o equal to or less than V_o ?	PASS

15. Measure distance S at inboard (i) and outboard (o) side of barrier.

$S_i = 648 \text{ mm}$

$S_o = 642 \text{ mm}$

16. Measure distance W at inboard (i) and outboard (o) sides of seat.

$W_i = 639 \text{ mm}$

$W_o = 653 \text{ mm}$

		PASS/FAIL
17.	Is $S_i + U_i$ equal to or greater than $W_i + V_i$?	PASS

		PASS/FAIL
18.	Is $S_o + U_o$ equal to or greater than $W_o + V_o$?	FAIL

DATA SHEET 6 (CONTINUED)

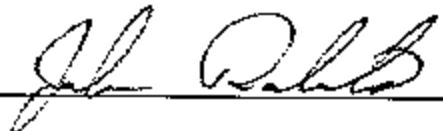
RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

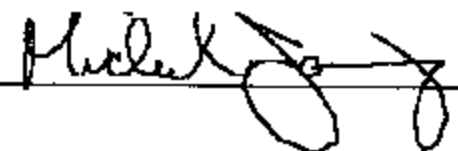
19. Compute area (W x A) = 593,028 mm²

20. Computer area (E x S) = 590,175 mm²

		PASS/FAIL
21.	Is (W x A) equal to or less than (E x S)?	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 6 (CONTINUED)

RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

Test Vehicle: 2003 Mid Bus Guide School Bus
Test Lab: MGA Research-Wisconsin Operations

NHTSA No.: C30903
Test Date: 6/11/03

BARRIER NUMBER: B9

See Figure 9 from OVSC TP-222-03 for diagram.

- Measure distance T from SRP of seat immediately aft of barrier in a horizontal longitudinal line forward to barrier. T = 495 mm

		PASS/FAIL
2.	Is distance T equal to or less than 610 mm? (S5.2)	PASS

- Measure distance D at top (t) and bottom (b) of barrier.

$D_t = 50$ mm $D_b = 12$ mm

- Measure distance C at top (t) and bottom (b) of seat.

$C_t = 64$ mm $C_b = 17$ mm

		PASS/FAIL
5.	Is D_t equal to or less than C_t ?	PASS

		PASS/FAIL
6.	Is D_b equal to or less than C_b ?	PASS

- Measure distance E at top of barrier and bottom of barrier.

$E_t = 873$ mm $E_b = 949$ mm

- Measure distance A at top of seat back and bottom of seat.

$A_t = 878$ mm $A_b = 968$ mm

DATA SHEET 6 (CONTINUED)

RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

		PASS/FAIL
9.	Is distance $E_i + D_i$ equal to or greater than distance $A_i + C_i$?	FAIL

		PASS/FAIL
10.	Is distance $E_o + D_o$ equal to or greater than distance $A_o + C_o$?	FAIL

11. Measure distance U at inboard (i) and outboard (o) side of barrier.

$U_i = 330$ mm

$U_o = 338$ mm

12. Measure distance V at inboard (i) and outboard (o) sides of seat.

$V_i = 327$ mm

$V_o = 352$ mm

		PASS/FAIL
13.	Is U_i equal to or less than V_i ?	FAIL

		PASS/FAIL
14.	Is U_o equal to or less than V_o ?	PASS

15. Measure distance S at inboard (i) and outboard (o) side of barrier.

$S_i = 650$ mm

$S_o = 652$ mm

16. Measure distance W at inboard (i) and outboard (o) sides of seat.

$W_i = 652$ mm

$W_o = 655$ mm

		PASS/FAIL
17.	Is $S + U_i$ equal to or greater than $W_i + V_i$?	PASS

		PASS/FAIL
18.	Is $S_o + U_o$ equal to or greater than $W_o + V_o$?	FAIL

DATA SHEET 6 (CONTINUED)

RESTRAINING BARRIER POSITION AND PROJECTED REAR SURFACE AREA

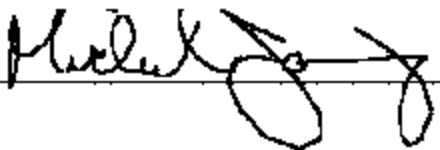
19. Compute area (W x A) = 603,180.5 mm²

20. Computer area (E x S) = 593,061 mm²

		PASS/FAIL
21.	Is (W x A) equal to or less than (E x S)?	FAIL

Comments: NONE

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 7
RESTRAINING BARRIER FORCE/DEFLECTION TEST

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

BARRIER IDENTIFICATION: B1

1. Seat cushion width of seat immediately rearward of restraining barrier = 995 mm
 $W = (\text{Seat Cushion Width})/381 \text{ mm (round to nearest whole number)} = (3)$
2. Location of SRP of seat rearward of restraining barrier is: (Description of location as supplied by the manufacturer): 475 mm Above Floor, 268.2 mm back from front of seat
3. Location of lower loading bar is 0 mm above the SRP.
(Requirement: between 102 mm above and 102 mm below the SRP) (S5.1.3.1)
Length of lower loading bar = 838 mm
Width of barrier at SRP = 928 mm
4. Include the x-y plot of force vs. time for the lower loading bar.
5. Deflection of the barrier at the conclusion of lower bar loading (1557W position) = 115 mm.
6. Maximum deflection allowed without moving the restraining barrier to within interference of door operation = 356 mm (must be 356 mm or less).
7. Barrier movement rate selected by the test engineer = 14.4 mm/sec
8. Location of upper loading bar is in a horizontal plane 406 mm above the SRP.
(Requirement: 406 mm) (S5.1.3.3)
Length of upper loading bar = 762 mm
Width of seat at 406 mm above the SRP = 838 mm
9. Reason for stopping restraining barrier deflection:
☐ Reached 356 mm maximum
☐ Separation was about to occur
☐ Interference with door operation
☒ Exceeded maximum load of 10,675 N
10. Maximum deflection of barrier back 204 mm (Requirement: maximum allowed is 356 mm) (S5.2.3(b))

DATA SHEET 7 (CONTINUED)
RESTRAINING BARRIER FORCE/DEFLECTION TEST

		PASS/FAIL
11.	Does the restraining barrier interfere with the normal operation of the door. (S5.2.3 (c))	PASS

		PASS/FAIL
12.	Did any separation of barrier component or the separation of the barrier from the vehicle occur? (S5.1.3 (d) & (e))	PASS

13. Include the x-y plot of force vs. deflection for the upper loading bar with boundaries of Figure 14 (OVSC TP-222-3) superimposed.

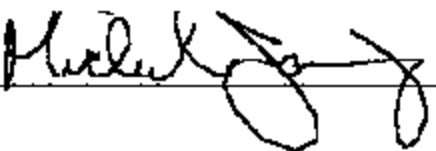
		PASS/FAIL
14.	Does the forward force vs. deflection trace of the barrier back lie within the unshaded area? (S5.2.3(a))	FAIL

15. Include a deflection vs. time plot for the upper loading bar.
 16. The area within the force vs. deflection curve = 1007 joules
 17. $452W = 1356$ joules (S5.2.3) (S5.1.3.4)

		PASS/FAIL
18.	Is item 16 greater than item 17? (a)	N/A

Comments: (a) Test terminated early due to high load readings.

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 7 (CONTINUED)
RESTRAINING BARRIER FORCE/DEFLECTION TEST

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

BARRIER IDENTIFICATION: B9

1. Seat cushion width of seat immediately rearward of restraining barrier = 995 mm
W = (Seat Cushion Width)/381 mm (round to nearest whole number) = (3)
2. Location of SRP of seat rearward of restraining barrier is: (Description of location as supplied by the manufacturer): 475 mm Above Floor, 268.2 mm back from front of seat
3. Location of lower loading bar is 0 mm above the SRP.
(Requirement: between 102 mm above and 102 mm below the SRP) (S5.1.3.1)
Length of lower loading bar = 838 mm
Width of barrier at SRP = 928 mm
4. Include the x-y plot of force vs. time for the lower loading bar.
5. Deflection of the barrier at the conclusion of lower bar loading (1557W position) = 122 mm.
6. Maximum deflection allowed without moving the restraining barrier to within interference of door operation = 356 mm (must be 356 mm or less).
7. Barrier movement rate selected by the test engineer = 14.4 mm/sec
8. Location of upper loading bar is in a horizontal plane 406 mm above the SRP.
(Requirement: 406 mm) (S5.1.3.3)
Length of upper loading bar = 762 mm
Width of seat at 406 mm above the SRP = 838 mm
9. Reason for stopping restraining barrier deflection:
☒ Reached 356 mm maximum
☐ Separation was about to occur
☐ Interference with door operation
10. Maximum deflection of barrier back 204 mm. (Requirement: maximum allowed is 356 mm) (S5.2.3(b))

DATA SHEET 7 (CONTINUED)
RESTRAINING BARRIER FORCE/DEFLECTION TEST

		PASS/FAIL
11.	Does the restraining barrier interfere with the normal operation of the door. (S5.2.3 (c))	PASS

		PASS/FAIL
12.	Did any separation of barrier component or the separation of the barrier from the vehicle occur? (S5.1.3 (d) & (e))	PASS

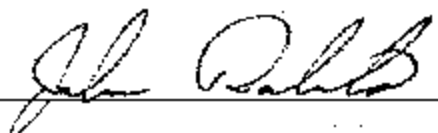
13. Include the x-y plot of force vs. deflection for the upper loading bar with boundaries of Figure 14 (OVSC TP-222-3) superimposed.

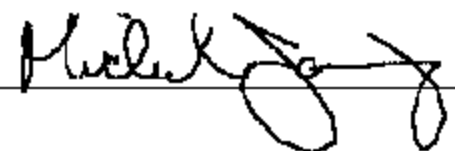
		PASS/FAIL
14.	Does the forward force vs. deflection trace of the barrier back lie within the unshaded area? (S5.2.3(a))	FAIL

15. Include a deflection vs. time plot for the upper loading bar.
 16. The area within the force vs. deflection curve = 1473 joules
 17. $452W = 1356$ joules (S5.2.3) (S5.1.3.4)

		PASS/FAIL
18.	Is item 16 greater than item 17?	PASS

Comments: NONE

Recorded By: 

Approved By: 

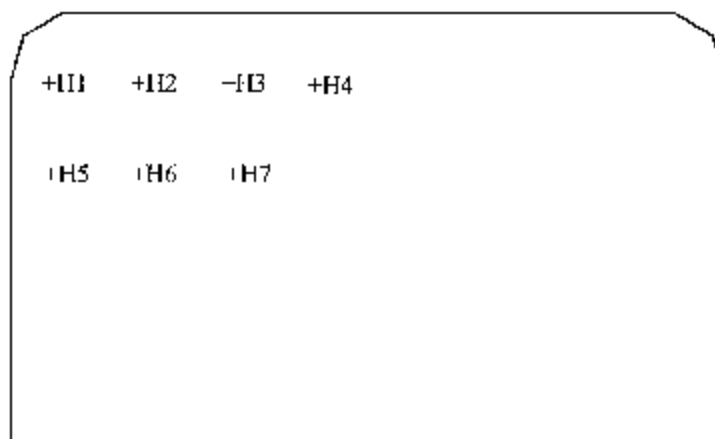
Date: September 30, 2003

DATA SHEET B
HEAD FORM IMPACT CONTACT AREA REQUIREMENT

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: S1



SEAT BACK REAR SURFACE

NOTE: SHADED AREA IS NONCONTACTABLE SURFACE

1. Locate x-y reference point on sketch above for head form impact locations. (Label the positive and negative directions, if applicable)
2. Identify head form impact location on sketch by placing H1, H2, H3, H4, H5, H6 and H7 in the appropriate location.
3. Define and mark on graphic above, the plane of reference for head form impact angle:
0° = Parallel With Floor, (+) is Up, (-) is Down
X = From Inboard Edge of Seat
Y = Up From Top Surface of Floor

DATA SHEET 8 (CONTINUED)
HEAD FORM IMPACT CONTACT AREA REQUIREMENT

14. Complete the following table:

(1) Head Impact & Test #	(2) Location			(3) Speed Trap Impact Velocity** mps	(4)* Derived Velocity mps	(5) Contact Area (CA) mm ²	(6) CA $\geq$ 1935 mm ² Yes- Pass	(7) No- Fail
	X	Y	Angle					
H1	815	410	0	1.52	1.37	5550	PASS	
H2	695	410	0	1.65 (a)	1.51	4610	PASS	
H3	575	410	0	1.53	1.39	5220	PASS	
H4	455	410	0	1.57	1.45	4460	PASS	
H5	815	310	0	1.62 (a)	1.42	4850	PASS	
H6	695	310	0	1.55	1.40	2760	PASS	
H7	575	310	0	1.52	1.38	2020	PASS	

* Contact Velocity from Item 7 below

** Velocity Range = 1.52 mps, +0.08, -0 mps

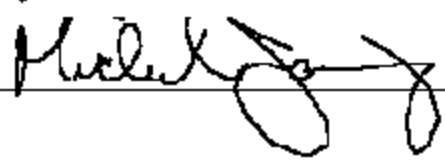
15. Attach Contact Area Prints.

16. Attach acceleration versus time plots for each impact.

17. Integrate the acceleration versus time plots and attach plots of the results that show velocity versus time.

Comments: (a) Impact velocity higher than allowed.

Recorded By: 

Approved By: 

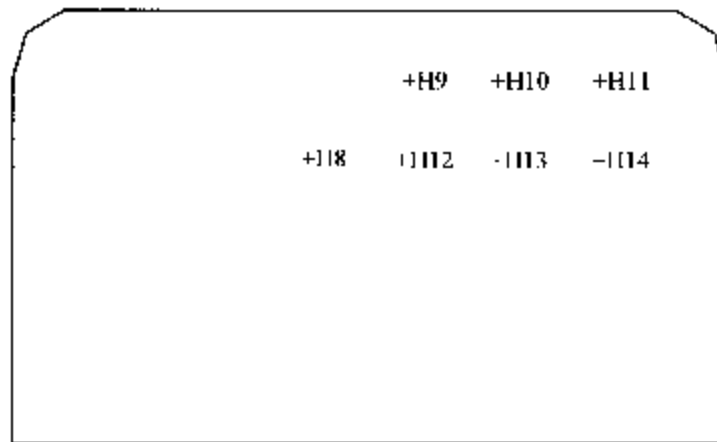
Date: September 30, 2003

DATA SHEET 9
HEAD FORM IMPACT ENERGY REQUIREMENT

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: S1



SEAT BACK REAR SURFACE

NOTE: SHADED AREA IS NONCONTACTABLE SURFACE

1. Locate x-y reference point on sketch above for head form impact locations. (Label the positive and negative directions, if applicable)
2. Identify head form impact location on sketch by placing H8, H9, H10, H11, H12, H13 and H14 in the appropriate location.
3. Define and mark on graphic above, the plane of reference for head form impact angle:
0° = Parallel With Floor, (+) is Up, (-) is Down
X = From Longitudinal Centerline of Vehicle
Y = Up From Top Surface of Floor

DATA SHEET 9 (CONTINUED)
HEAD FORM IMPACT ENERGY REQUIREMENT

4. Complete the following table:

(1) Head Impact & Test #	(2) Location			(3) Speed Trap Impact Velocity ** mps	(4)* Derived Velocity ** mps	(5) Max HIC	(6) Engy Reqd Joules	(7) Column 5 < 1000		(8) Column 6 > 4.5 joules	
	X	Y	Angle					Yes- Pass	No- Fail	Yes- Pass	No- Fail
H8	455	310	0	6.57 (a)	6.44	108	12.9	PASS		PASS	
H9	335	410	0	6.75 (b)	6.52	93	4.8	PASS		PASS	
H10	215	410	0	6.70 (b)	6.43	97	4.7	PASS		PASS	
H11	95	410	0	6.75 (b)	6.34	99	6.6	PASS		PASS	
H12	335	310	0	6.73 (b)	6.56	101	13.7	PASS		PASS	
H13	215	310	0	6.66	6.66	81	17.0	PASS		PASS	
H14	95	310	0	6.66	6.58	119	5.9	PASS		PASS	

* Impact velocity from item No. 6 below

** Impact velocity range = 6.69 mps, +0, -0.08 mps

5. Attach acceleration versus time plots for each impact.
6. Integrate the acceleration versus time plots and attach plots of the results that show velocity versus time.

Comments: (a) Impact velocity lower than allowed.
 (b) Impact velocity higher than allowed.

Recorded By: _____

Approved By: _____

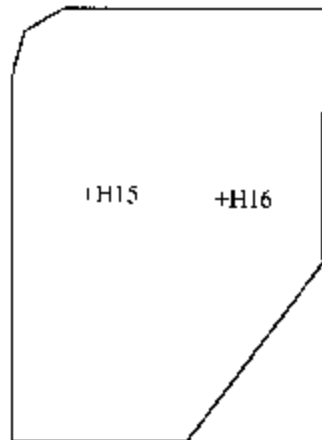
Date: September 30, 2003

DATA SHEET 9 (CONTINUED)
HEAD FORM IMPACT ENERGY REQUIREMENT

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

SEAT NUMBER: Barrier Above and Behind Driver's Seat



WALL BARRIER REAR SURFACE BEHIND DRIVER

NOTE: SHADED AREA IS NONCONTACTABLE SURFACE

1. Locate x-y reference point on sketch above for head form impact locations. (Label the positive and negative directions, if applicable)
2. Identify head form impact location on sketch by placing H8, H9, H10, H11, H12, H13 and H14 in the appropriate location.
3. Define and mark on graphic above, the plane of reference for head form impact angle:
0° = Parallel With Floor, (+) is Up, (-) is Down
X = From Longitudinal Centerline of Vehicle
Y = Up From Top Surface of Floor

DATA SHEET 9 (CONTINUED)
HEAD FORM IMPACT ENERGY REQUIREMENT

4. Complete the following table:

(1) Head impact & Test #	(2) Location			(3) Speed Trap Impact Velocity ** mps	(4)* Derived Velocity ** mps	(5) Max HIC	(6) Engy Reqd Joules	(7) Column 5 < 1000		(8) Column 6 > 4.5 joules	
	X	Y	Angle					Yes- Pass	No- Fail	Yes- Pass	No- Fail
H15	665	841	0	6.62	6.31	243	5.8	PASS		PASS	
H16	515	841	0	6.49 (a)	6.08	264	5.7	PASS		PASS	

* Impact velocity from item No. 6 below

** Impact velocity range = 6.69 mps, +0, -0.08 mps

5. Attach acceleration versus time plots for each impact.
6. Integrate the acceleration versus time plots and attach plots of the results that show velocity versus time.

Comments: (a) Impact velocity lower than allowed.

Recorded By: _____

Approved By: _____

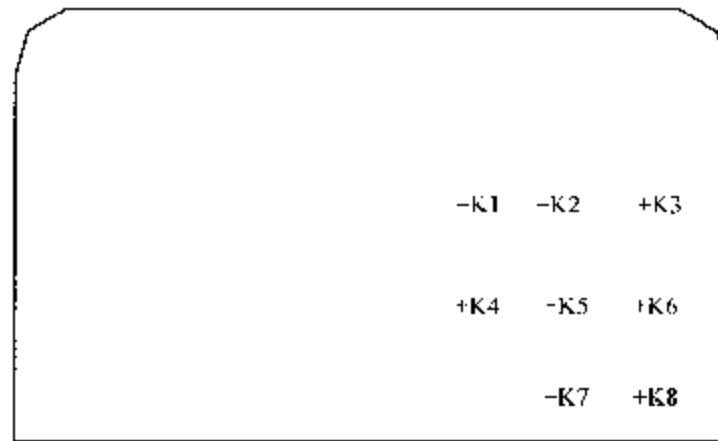
Date: September 30, 2003

DATA SHEET 10
KNEE FORM IMPACT TEST

Test Vehicle: **2003 Mid Bus Guide School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/20/03**

SEAT NUMBER: S1



SEAT BACK REAR SURFACE

1. Locate x-y reference point on sketch above for knee form impact locations. (Label the positive and negative directions, if applicable)
2. Identify knee form impact location on sketch by placing K1, K2, K3, K4, K5, K6, K7, and K8 in the appropriate location.
3. Define the plane of reference for knee form impact angle:
0° = Parallel With Floor, (+) is Up, (-) is Down
X = From Longitudinal Centerline of Vehicle
Y = Up From Top Surface of Floor

DATA SHEET 10 (CONTINUED)
KNEE FORM IMPACT TEST

4. Complete the following table:

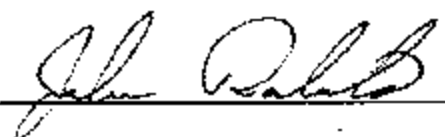
(1) Knee impact & Test #	(2) Location			(3) Speed Trap Impact Velocity ** mps	(4)* Derived Velocity ** mps	(5) Cont. Area mm ²	(6) Resist Force (N)	(7) Column 5 > 1935 mm ²		(8) Column 6 < 2669N	
	X	Y	Angle					Yes- Pass	No- Fail	Yes- Pass	No- Fail
K1	300	190	0	4.88	4.8	3410	1394	PASS		PASS	
K2	185	190	0	4.89	4.59	4510	1378	PASS		PASS	
K3	65	190	0	4.87	4.80	4000	1352	PASS		PASS	
K4	300	70	0	4.89	4.78	4090	1338	PASS		PASS	
K5	185	70	0	4.83	4.88	N/A	1302	N/A		PASS	
K6	65	70	0	4.83	4.90	N/A	1284	N/A		PASS	
K7	185	-50	0	4.96 (a)	5.04	N/A	1359	N/A		PASS	
K8	65	-50	0	4.86	4.92	N/A	1332	N/A		PASS	

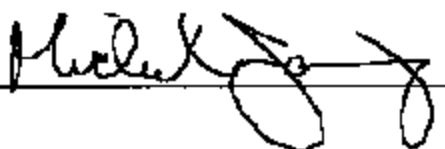
* Impact velocity from item No. 7 below

** Impact velocity range = 4.86 mps, +0.08, -0 mps for contact area, +0, -0.08 mps for force

5. Attach Contact Area Prints for K1, K2, K3 and K4.
6. Attach acceleration versus time plots for each impact.
7. Integrate the acceleration versus time plots and attach plots of the results that show velocity versus time for each impact K1 through K8.
8. Attach force vs. time plots for K5, K6, K7 and K8.

Comments: (a) Impact velocity higher than allowed.

Recorded By: 

Approved By: 

Date: September 30, 2003

DATA SHEET 11

WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES

WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGES AND RESTRAINTS

Test Vehicle: **2003 Mid Bus Guide School Bus**
 Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
 Test Date: **6/20/03**

WHEELCHAIR LOCATIONS: W5

		PASS/FAIL
1.	Are all wheelchair securement and occupant restraint anchorages designed for forward wheelchair position?	PASS

		PASS/FAIL
2.	Each wheelchair location shall have not less than four wheelchair securement anchorages (Type A or C) – two located in front of the wheelchair and two in the rear. Type C anchorage may be used in rear of the wheelchair only. Number of Type A anchorages in front of the wheelchair (≥ 2 Pass; < 2 Fail)	PASS

		PASS/FAIL
3.	Number of anchorages behind the wheelchair (≥ 2 Pass; < 2 Fail): Type A <u>0</u> ; Type C <u>2</u> ; Total: 2	PASS

		PASS/FAIL
4.	Each wheelchair location shall have not less than two wheelchair occupant pelvis and upper torso restraint anchorage (Type B, C, or combination). The pelvic belt must not terminate at the wheelchair. Number of anchorages (≥ 2 Pass; < 2 Fail): Type B <u>0</u> ; Type C <u>2</u> ; Total: 2	PASS

		PASS/FAIL
5.	The wheelchair location has at least one Type D anchorage:	PASS

		PASS/FAIL
6.	The wheelchair securement device has means to limit movement of the wheelchair.	PASS

DATA SHEET 11 (CONTINUED)
WHEELCHAIR SECUREMENT ANCHORAGES AND DEVICES
WHEELCHAIR OCCUPANT RESTRAINT ANCHORAGES AND RESTRAINTS

Wheelchair Location	Anchorage Location	Anchorage Type	Required Load (Newtons)	Actual Max. Test Load (Newtons)	Pass/Fail	Comment
W5	LF	A	13,334	*		
	RF	A	13,334	*		
	LR	A,B	26,668	13,108	FAIL	25° Right 60° Up
	RR	A,B	26,668	*		
	Upper Torso (a)	D	6,672	7,382	PASS	30° Right 18° Down

Comments: * Not Tested due to left rear anchor failure.

(a) Belt retractor slipped causing the cylinder to overload (see plot).

Recorded By: _____

Approved By: _____

Date: September 30, 2003

SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

Test Vehicle: **2003 American Transportation Corp IC3S530 School Bus**
Test Lab: **MGA Research-Wisconsin Operations**

NHTSA No.: **C30903**
Test Date: **6/11/03**

Equipment	Description	Model/Serial No.	Cal. Date	Next Cal. Date
Computer	HP	Vectra / US03263612	---	---
Test Fixture	MGA	TF2003	---	---
A/D Interface	Metrabyte	DAS-1802	---	---
Load Cell	Interface	1210AF-SK / 61219	2/10/03	8/10/03
Load Cell	Interface	1220 AF / 143280	5/27/03	11/27/03
Inclinometer	Digital Protractor	Pro 360 / Comp Lab	5/20/03	11/20/03
Linear Potentiometer	Celeisco	PT-101-40A / A04253	6/11/03	7/8/03
Scale	GEI	Metric / 1	1/6/03	7/6/03
Steel Tape	Stanley	Powerlock / 101	4/9/03	10/9/03
Impact Fixture	MGA	IF2003A	---	---
Camera	Sony	DSC-S75	---	---
Planimeter	Sokkia Corp.	Planix5 007319	3/7/03	6/5/03
Accelerometer	Endevco	7264-2000 / AN7F1	3/20/03	9/20/03
Temp Recorder	Oregon Scientific	WM-918	10/18/02	4/18/03
Linear Motion Transducer	Ametek	P-25A / 1202- 19366	12/16/02	6/16/03
Linear Motion Transducer	Ametek	P25A / 1102- 19182	12/16/02	6/16/03
Belt Anchor Fixture	MGA	BAF 2003	---	---

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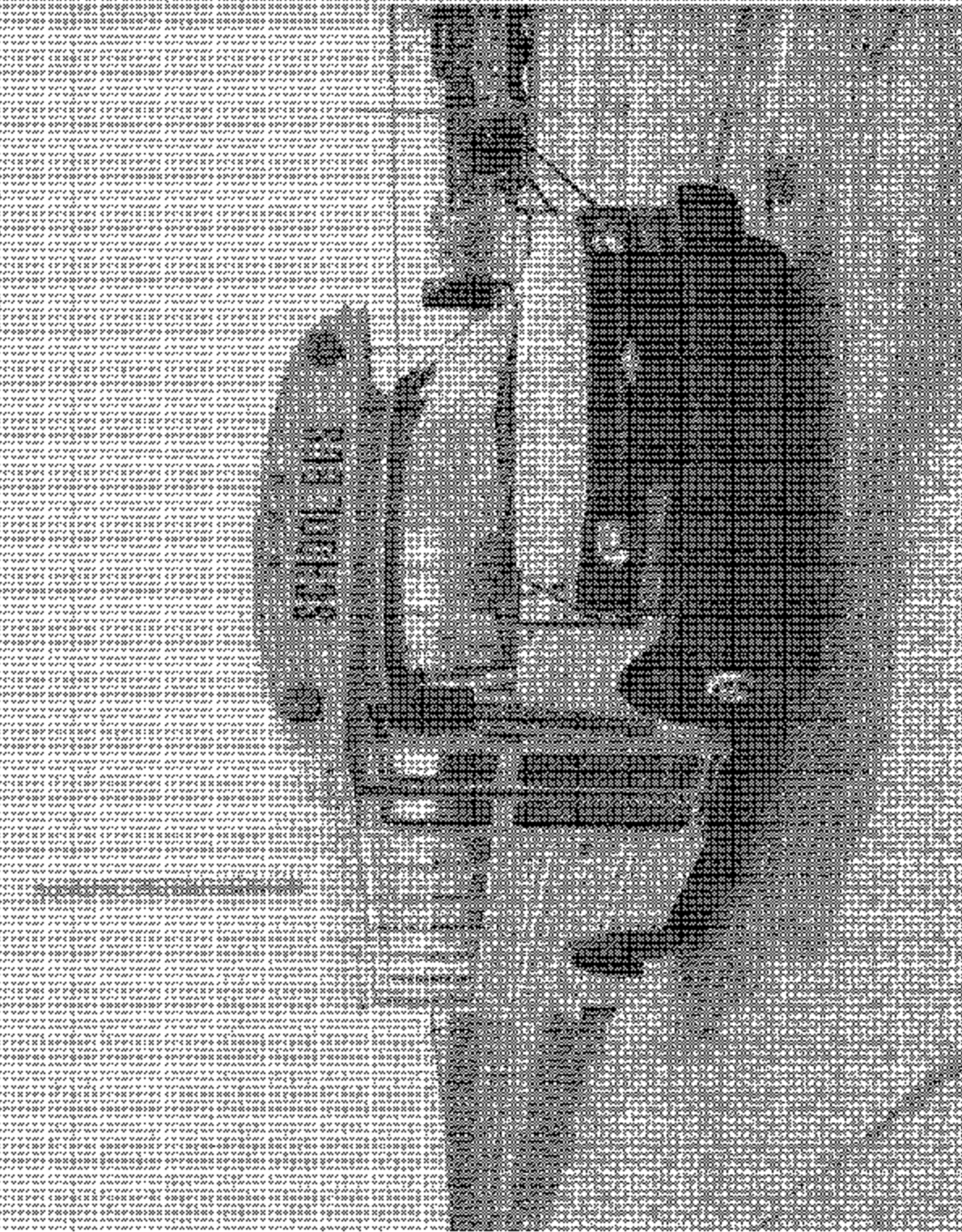
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EMASS 227

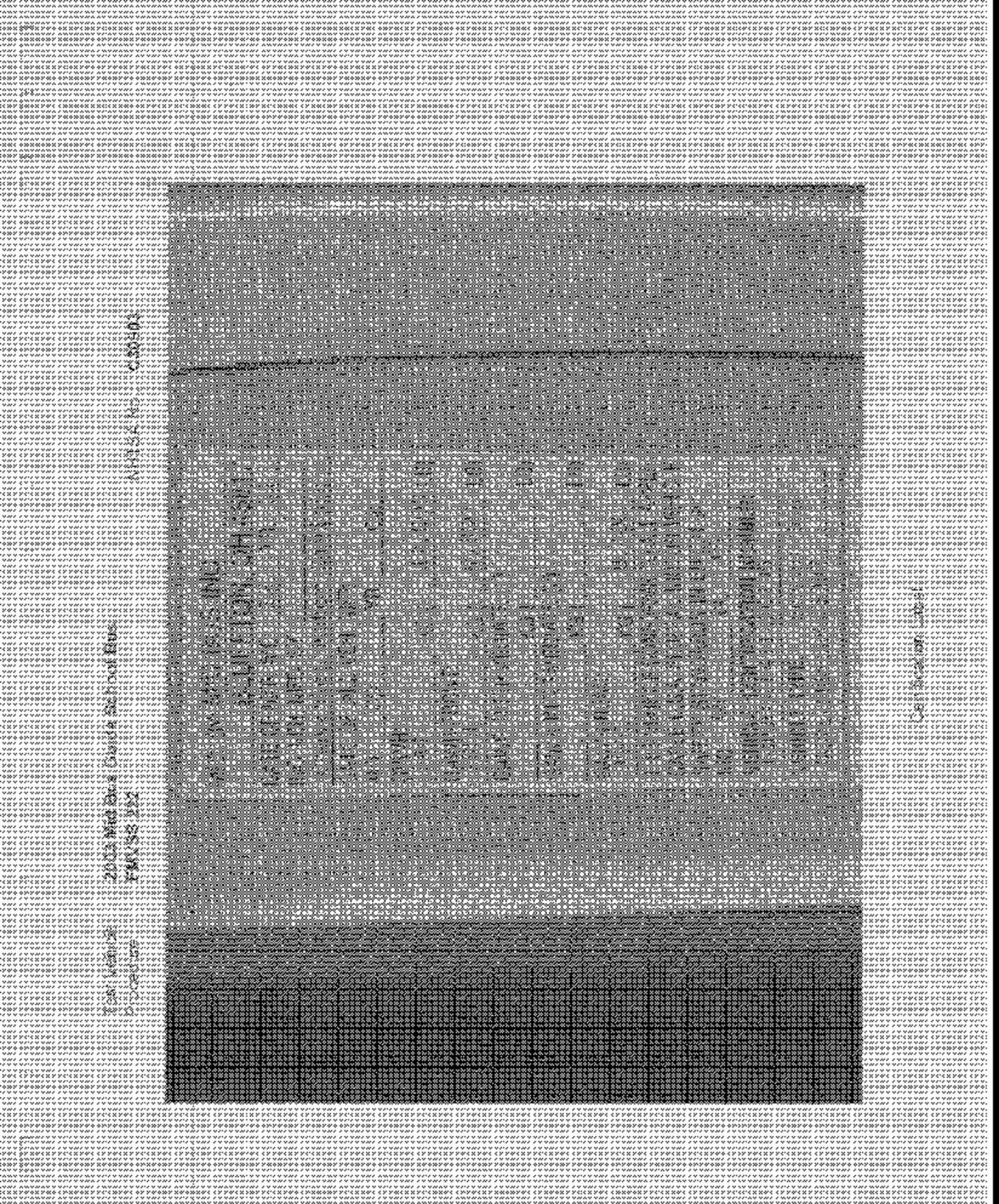
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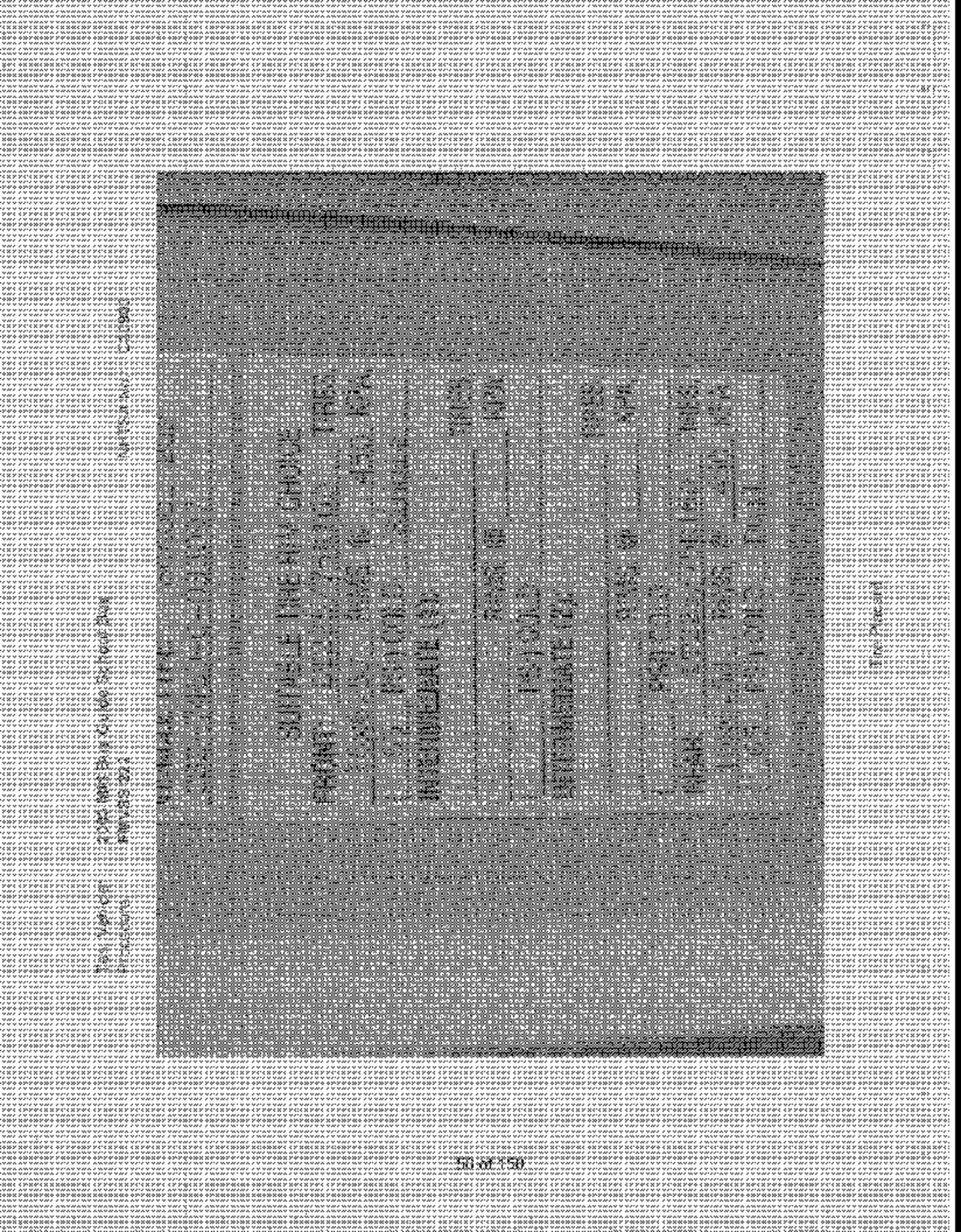
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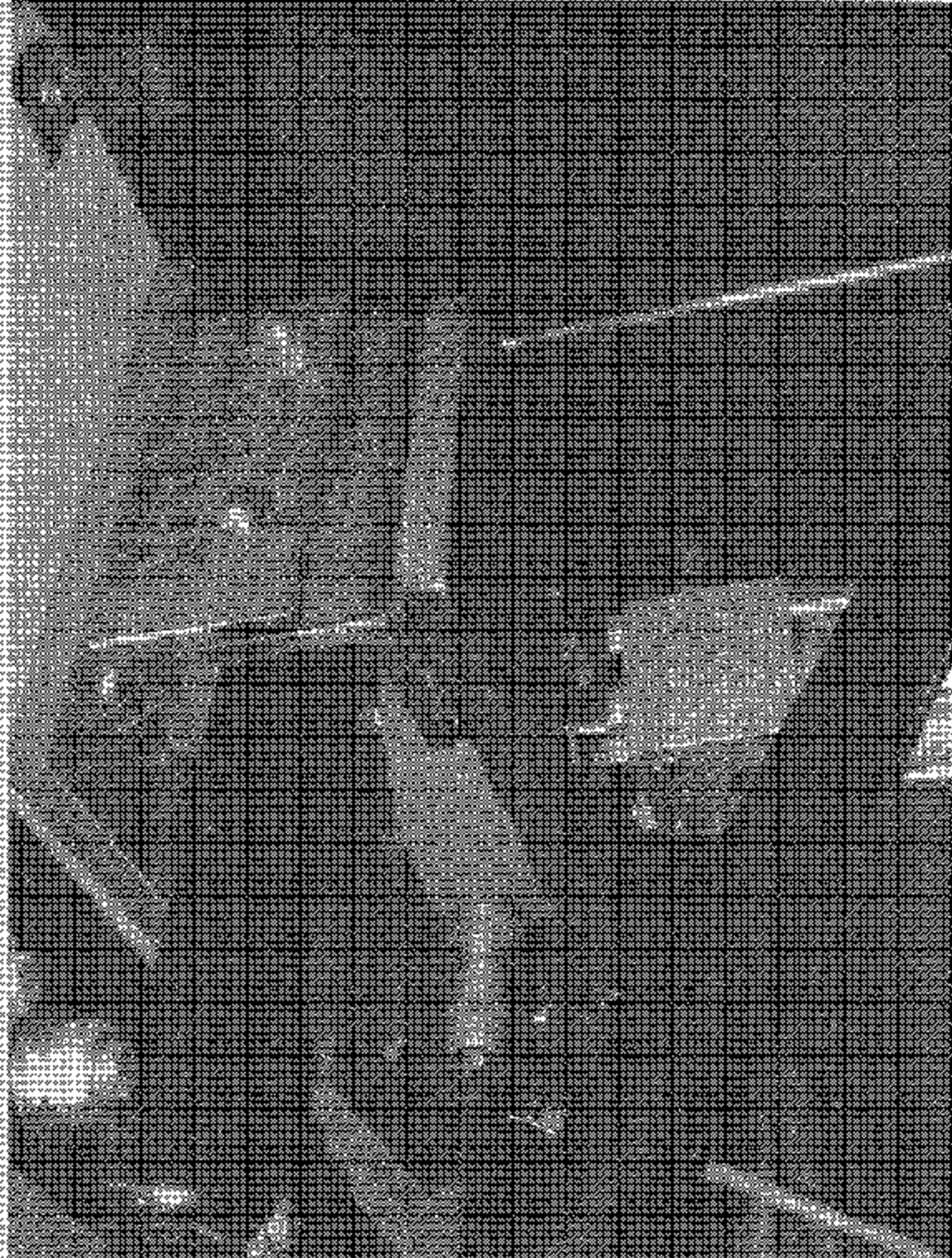
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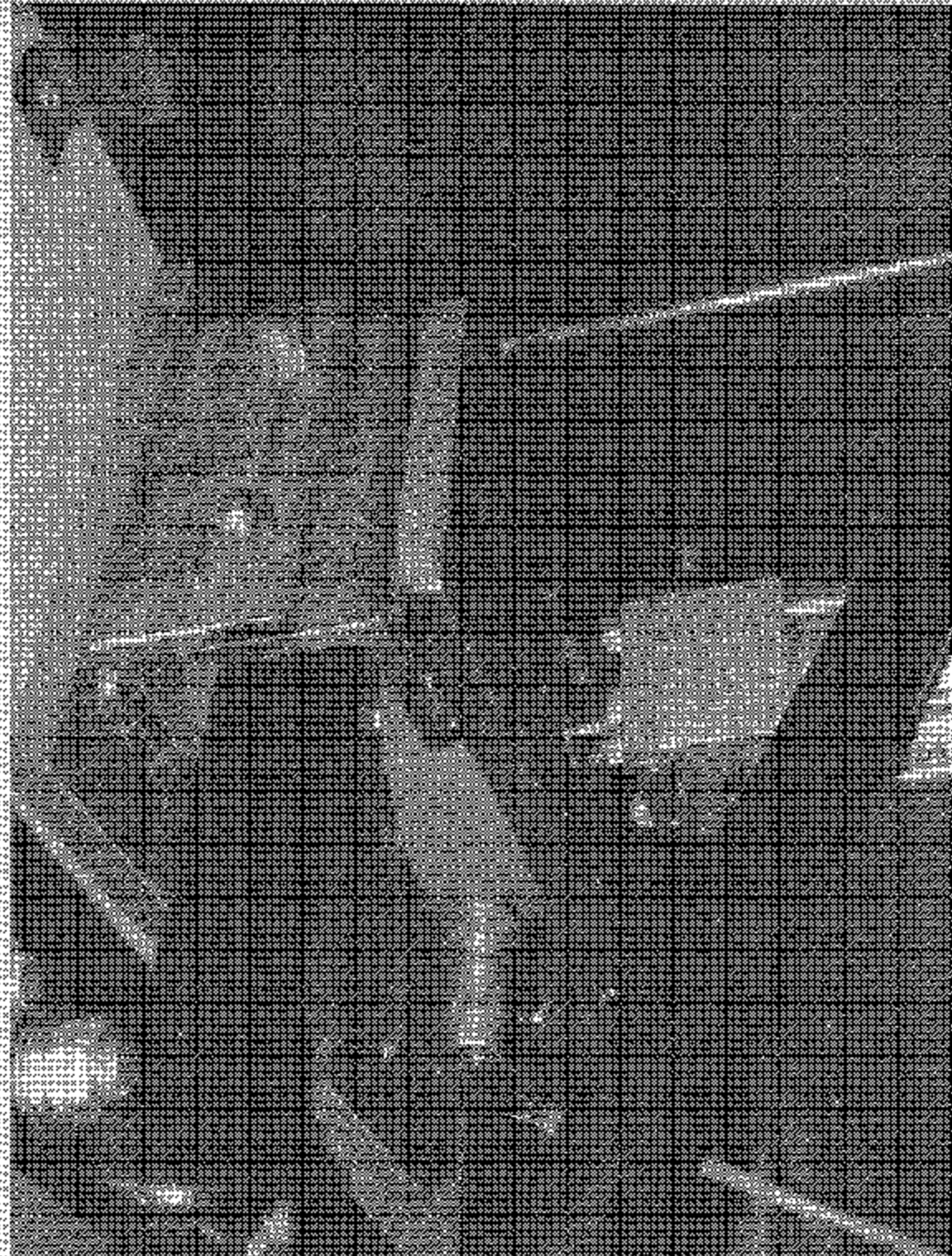
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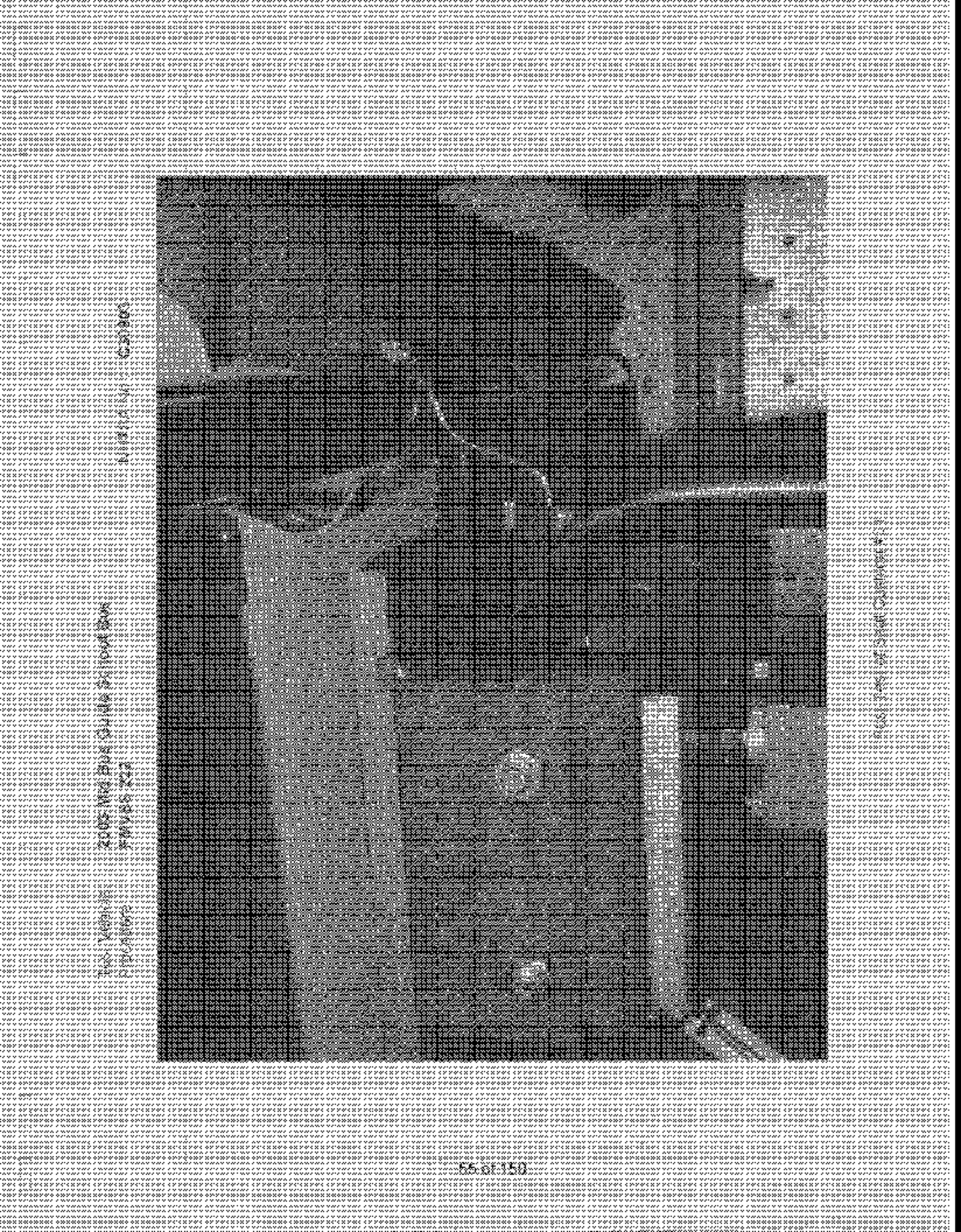
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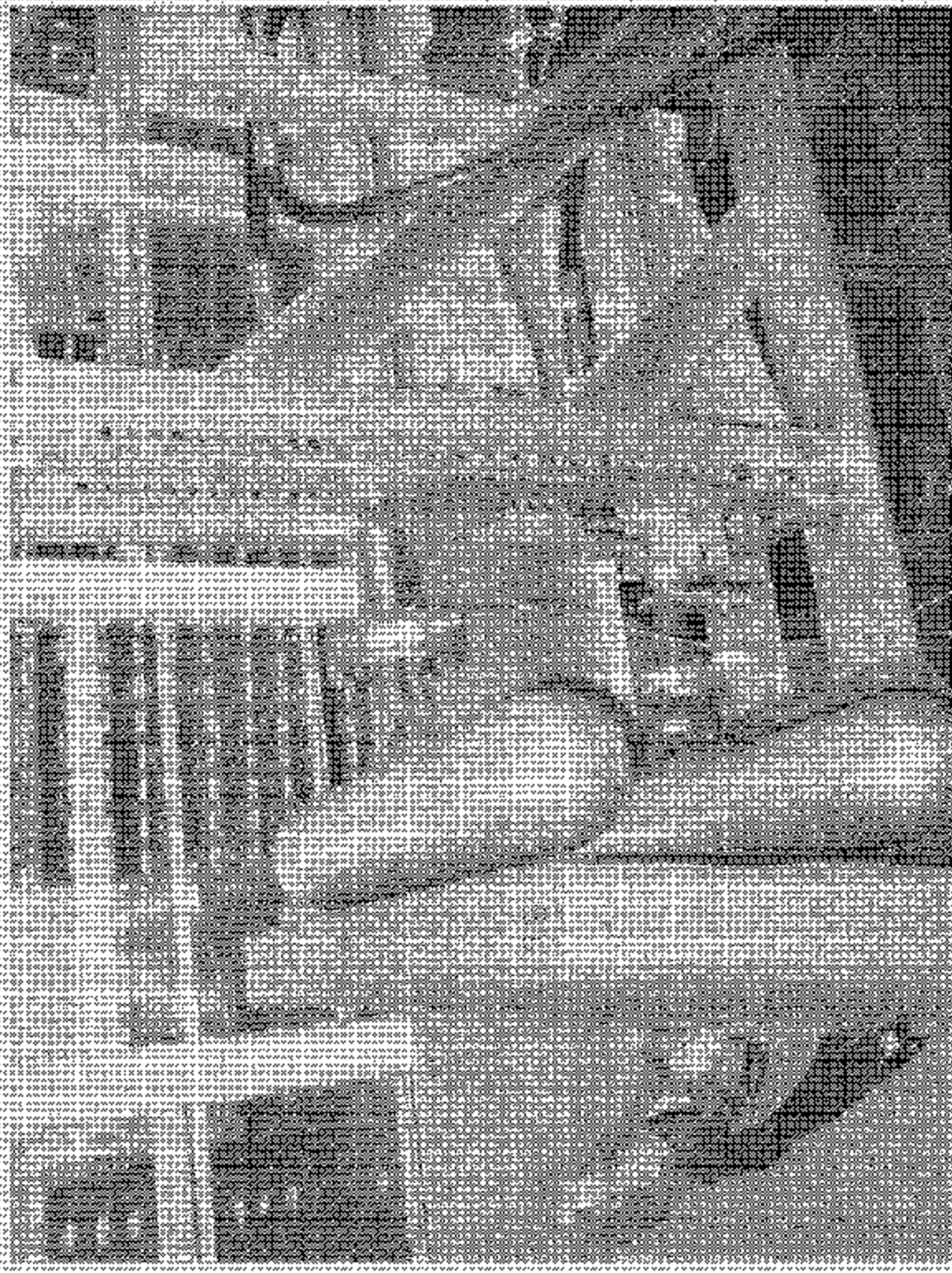
PLANS 222

PLAN 222



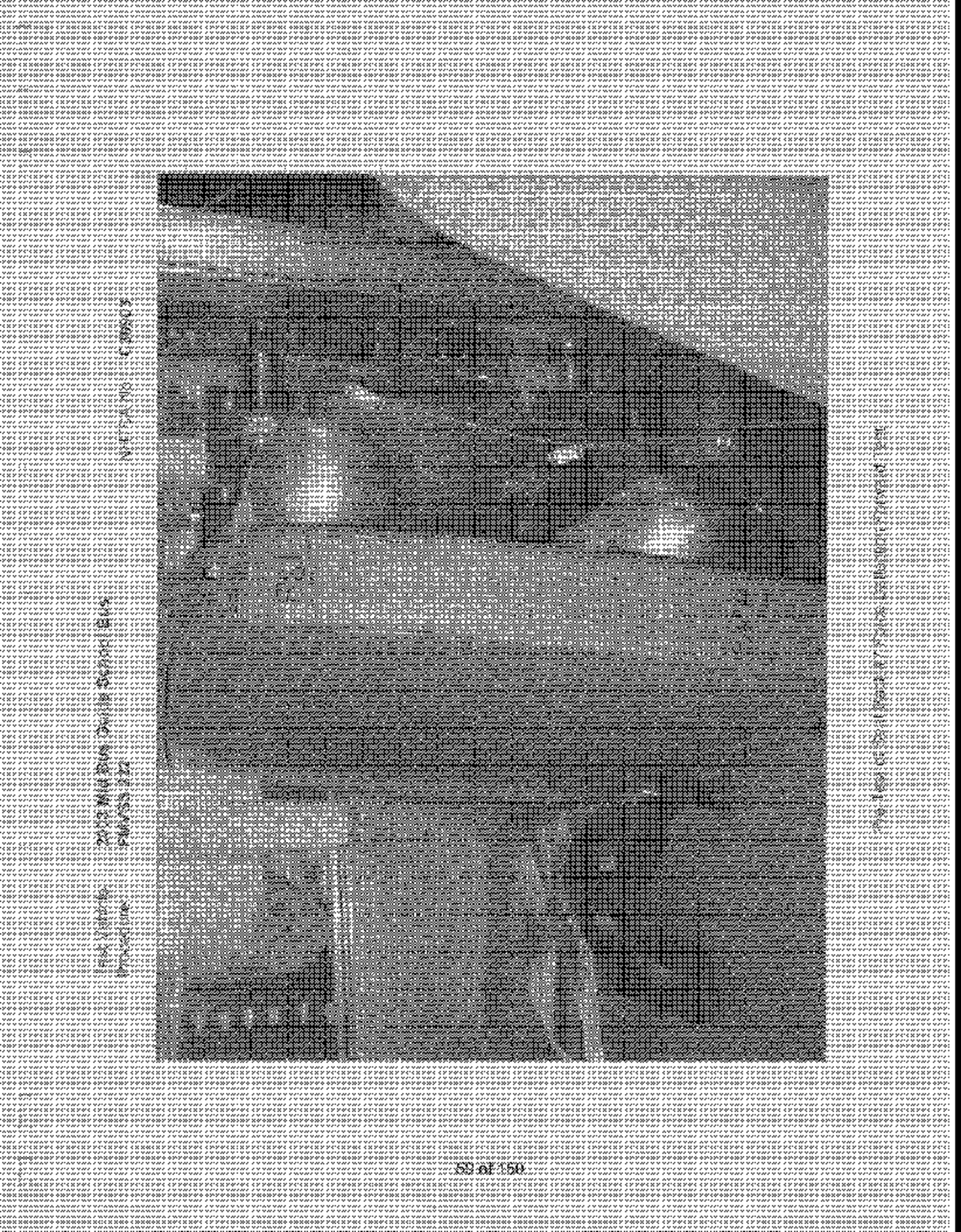


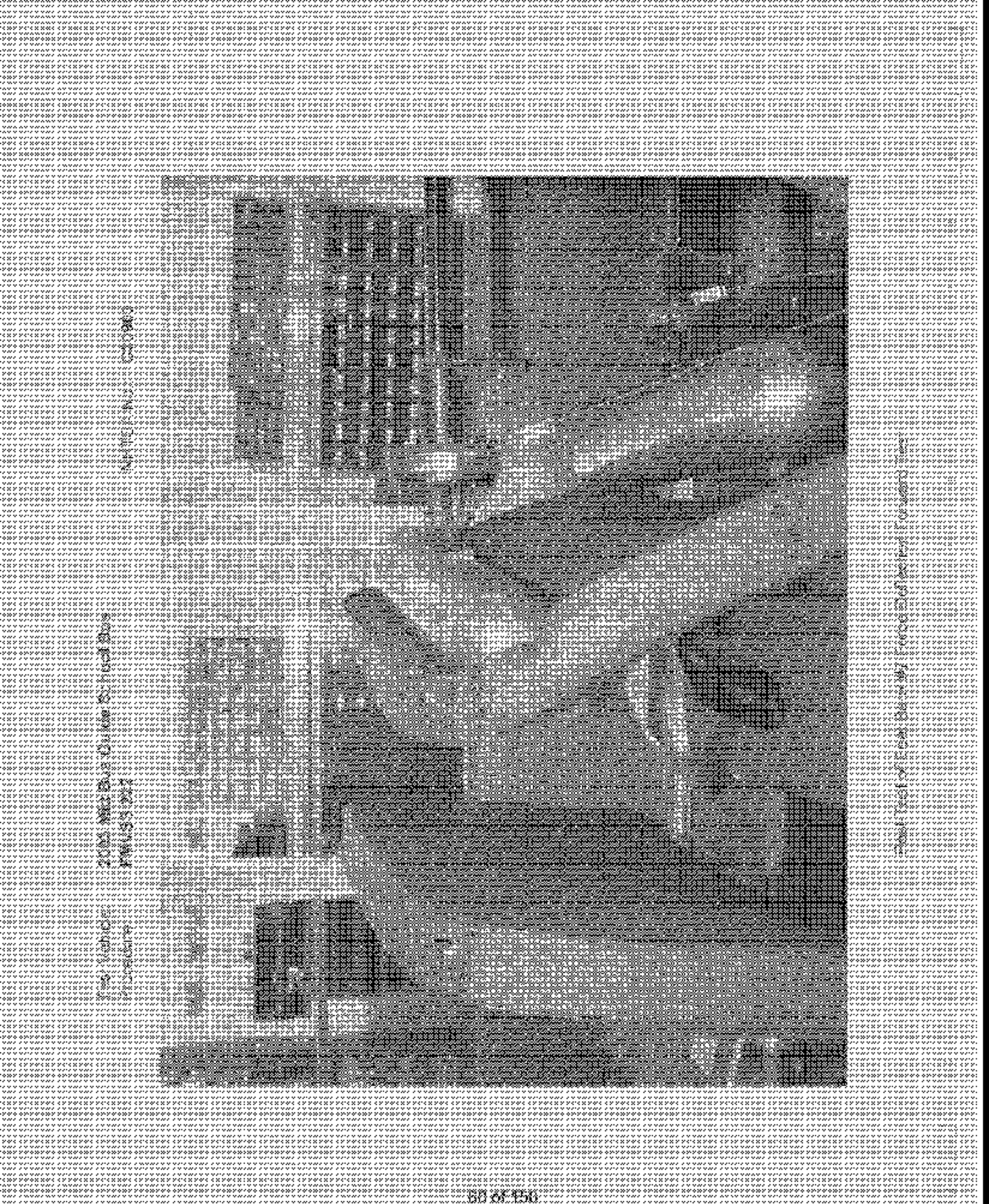


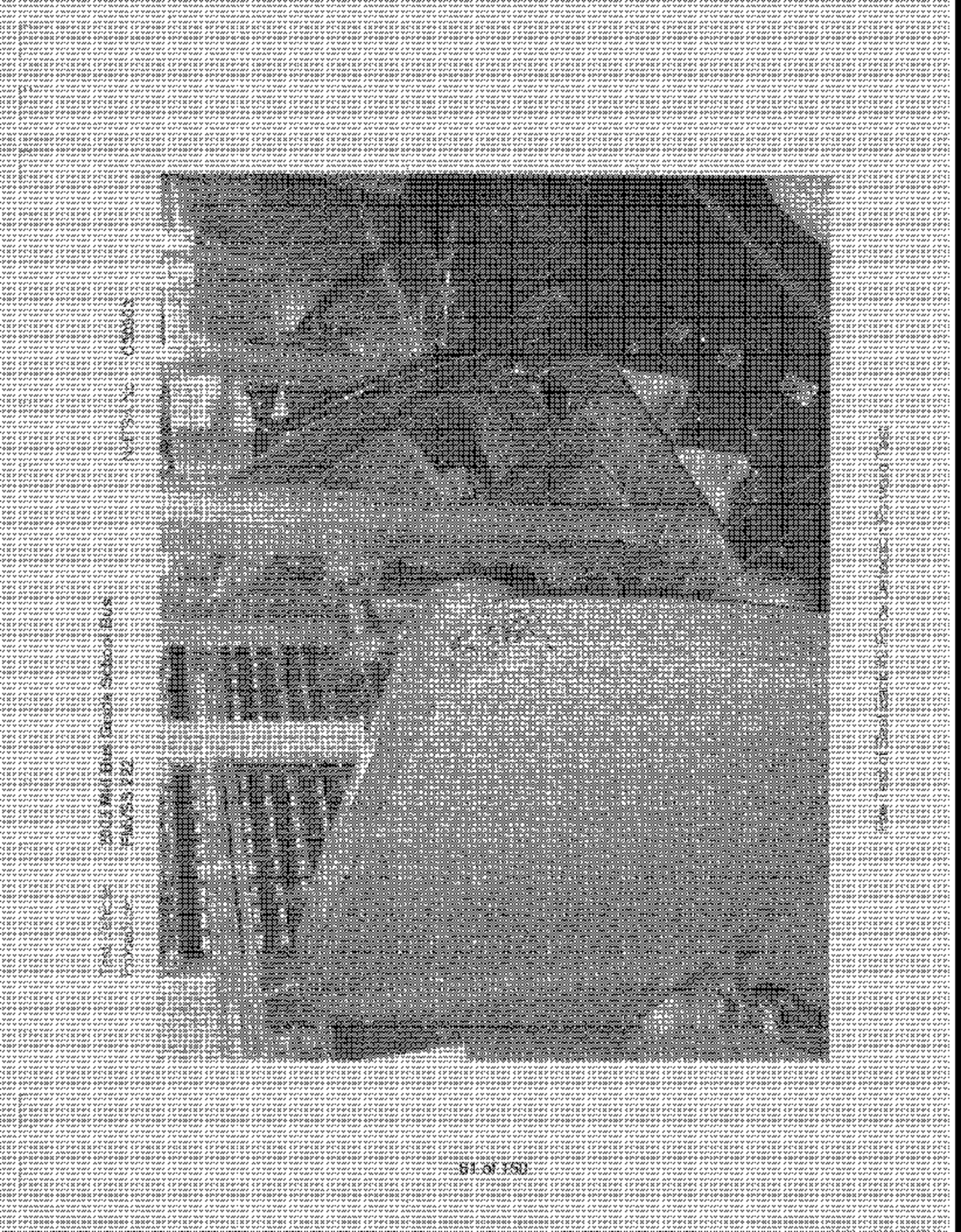


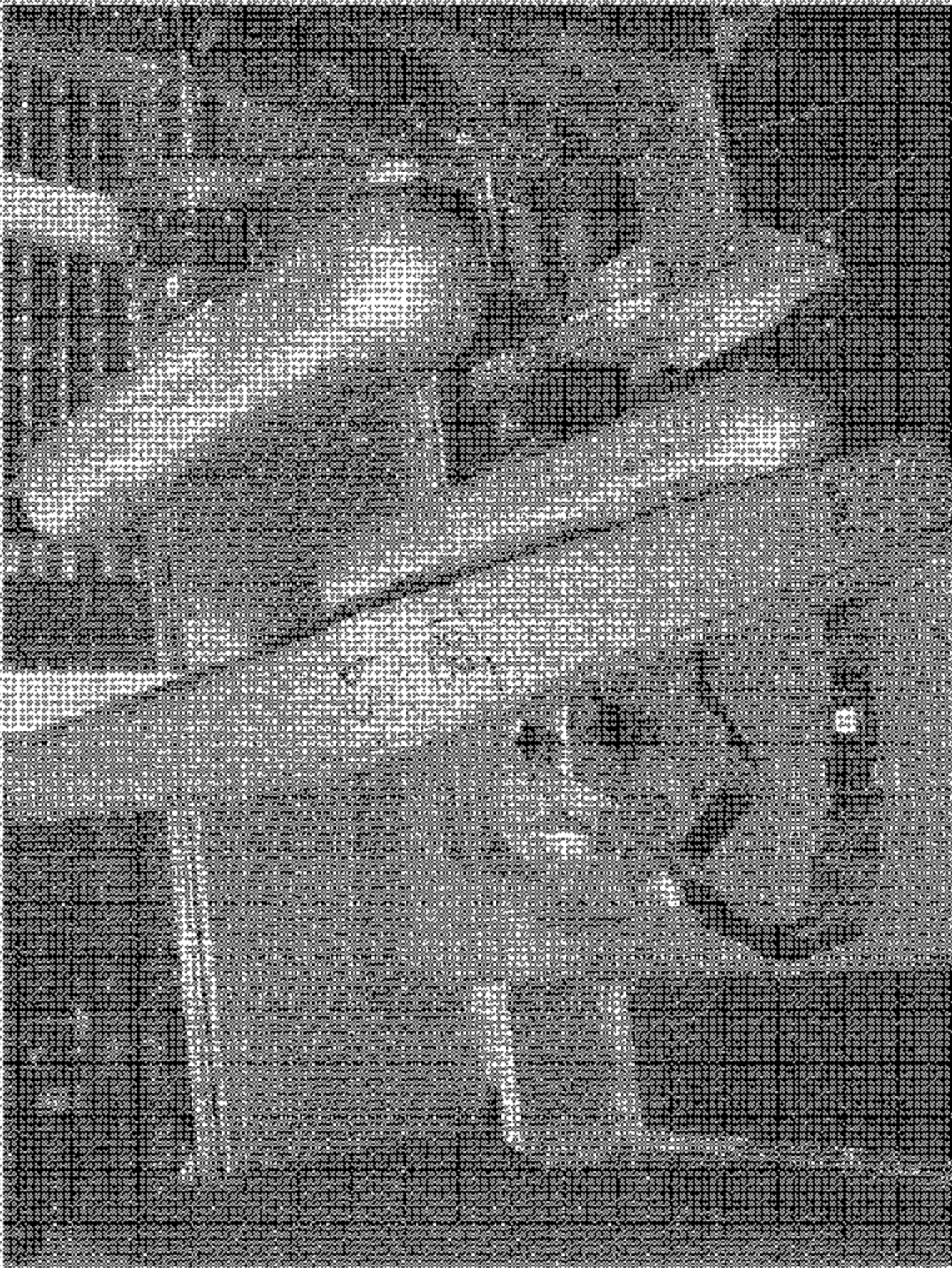


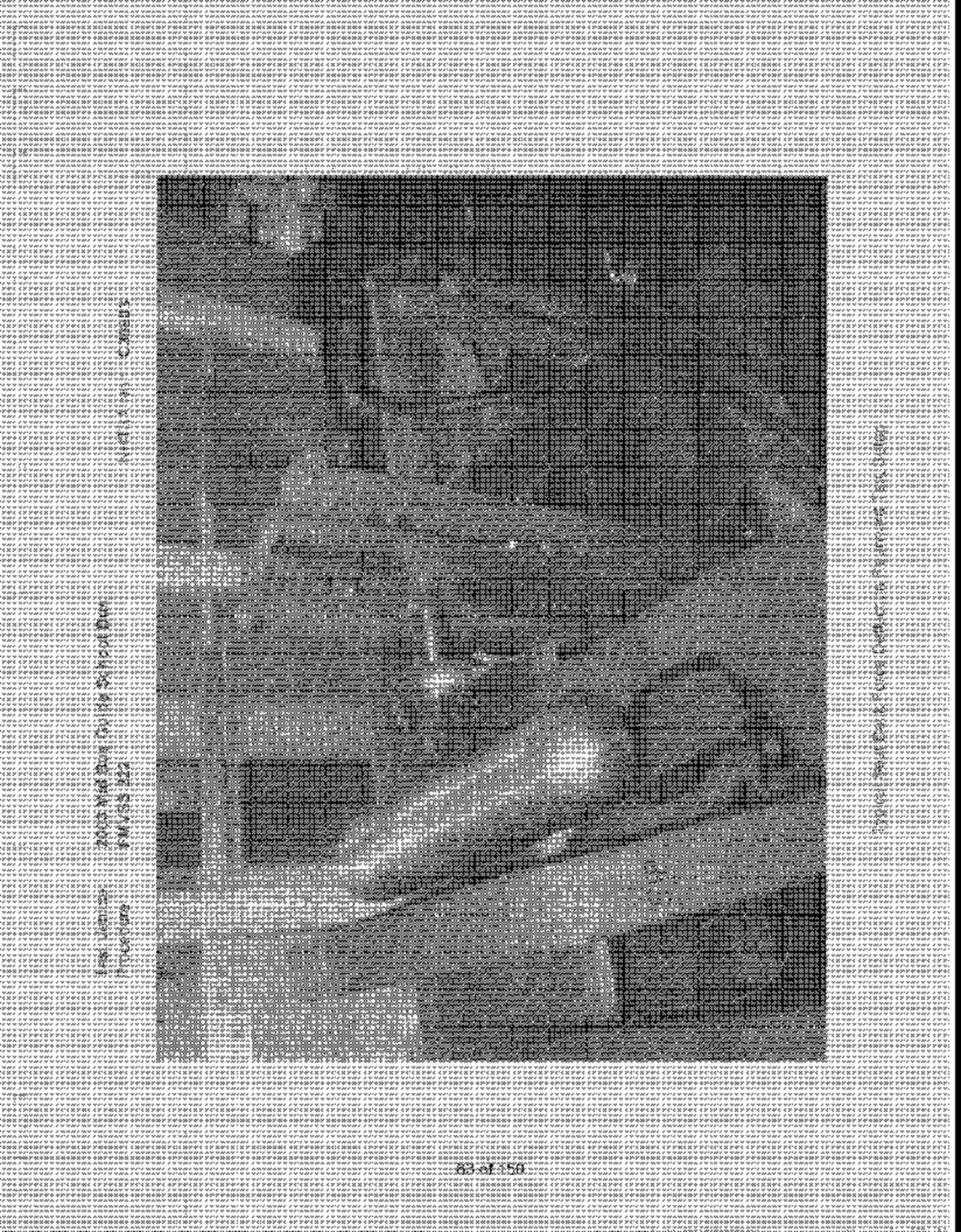


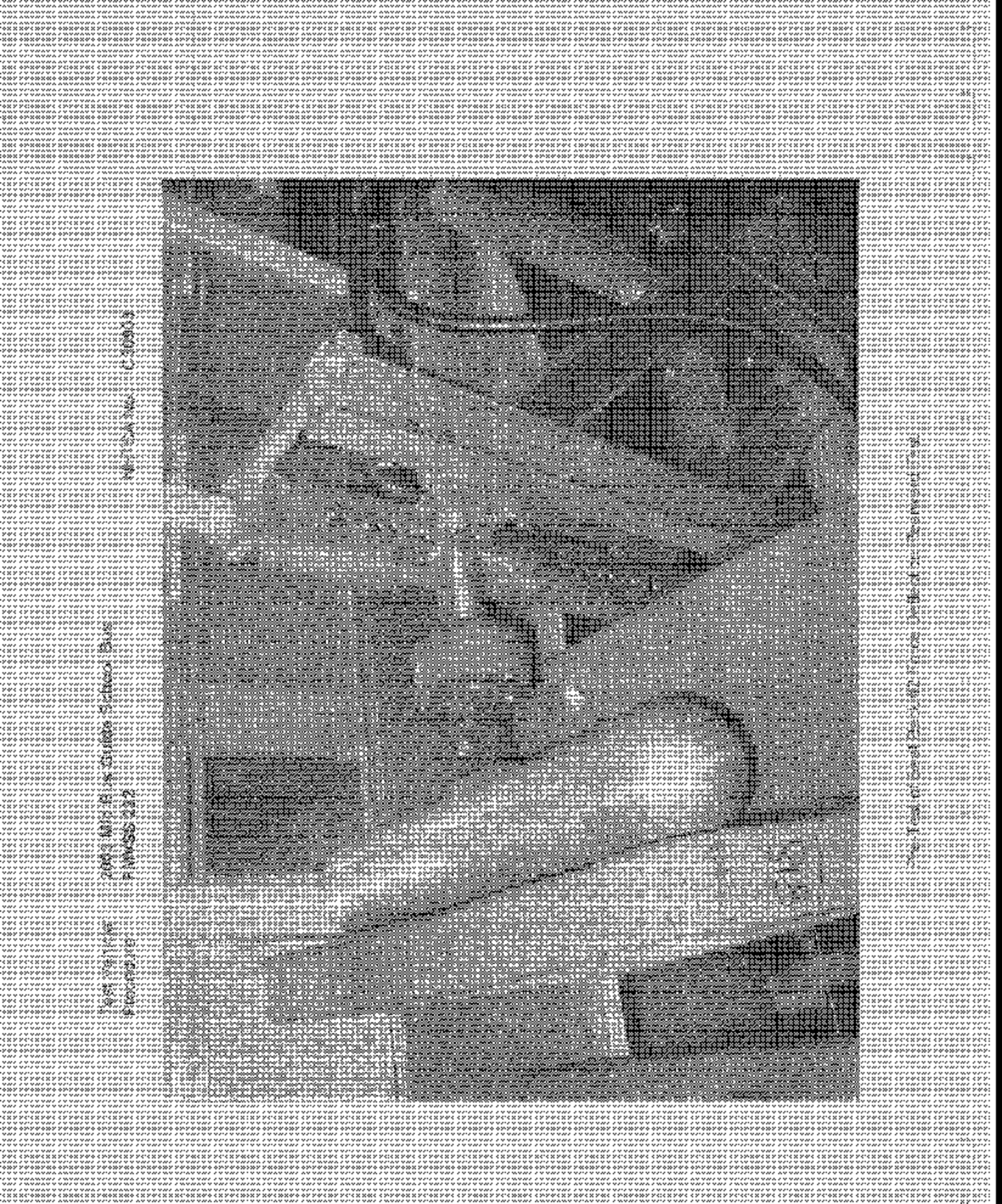


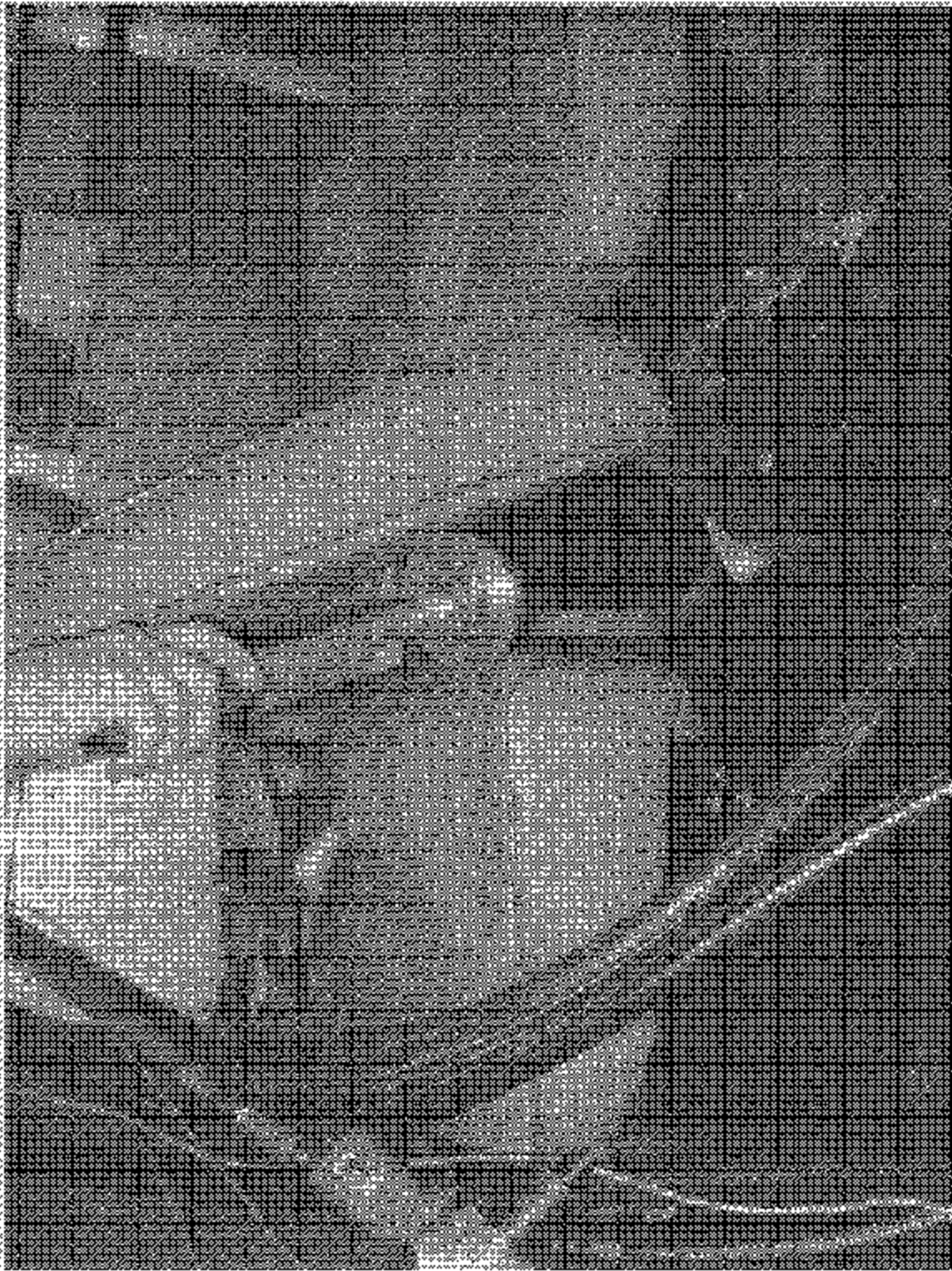


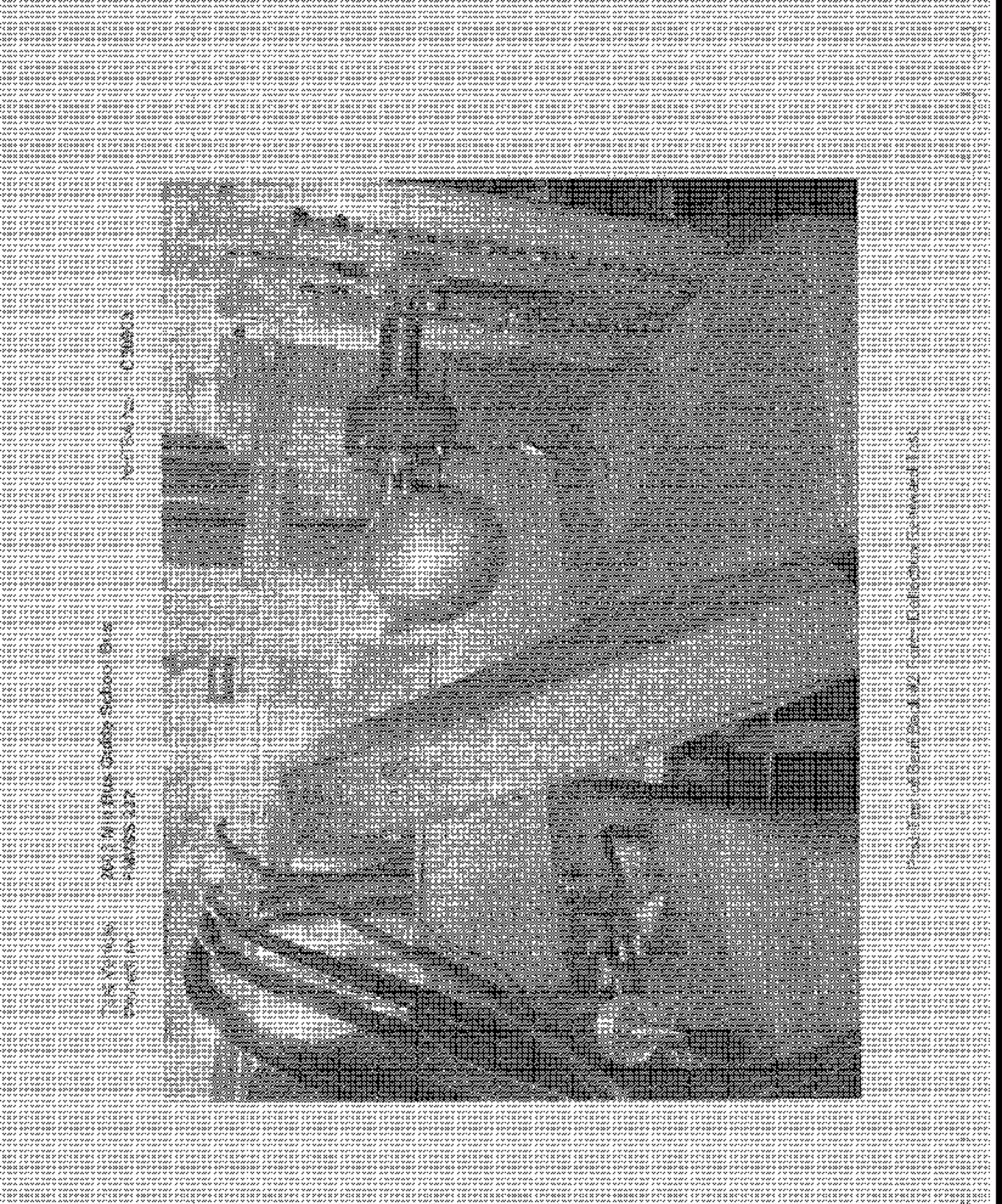


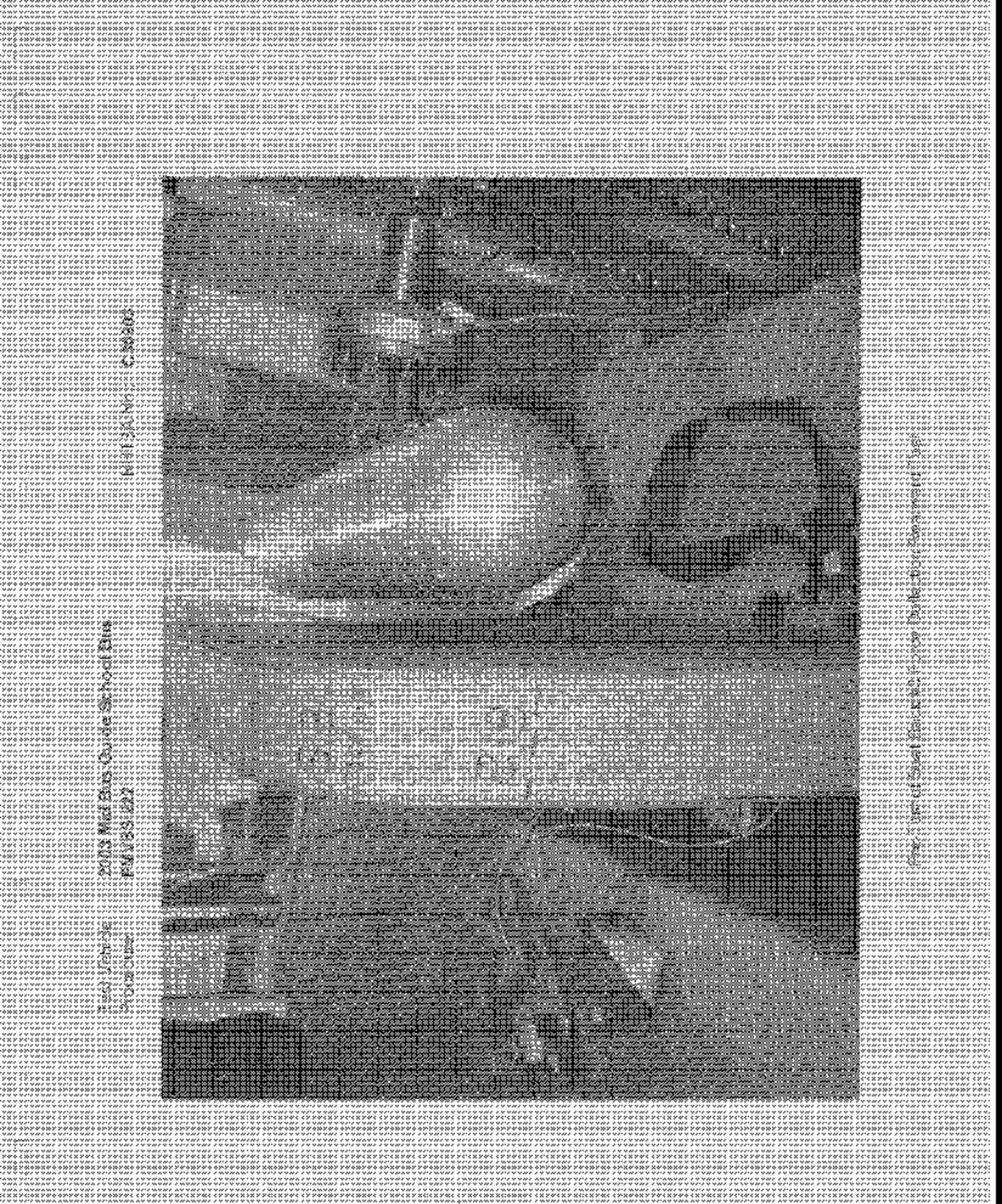


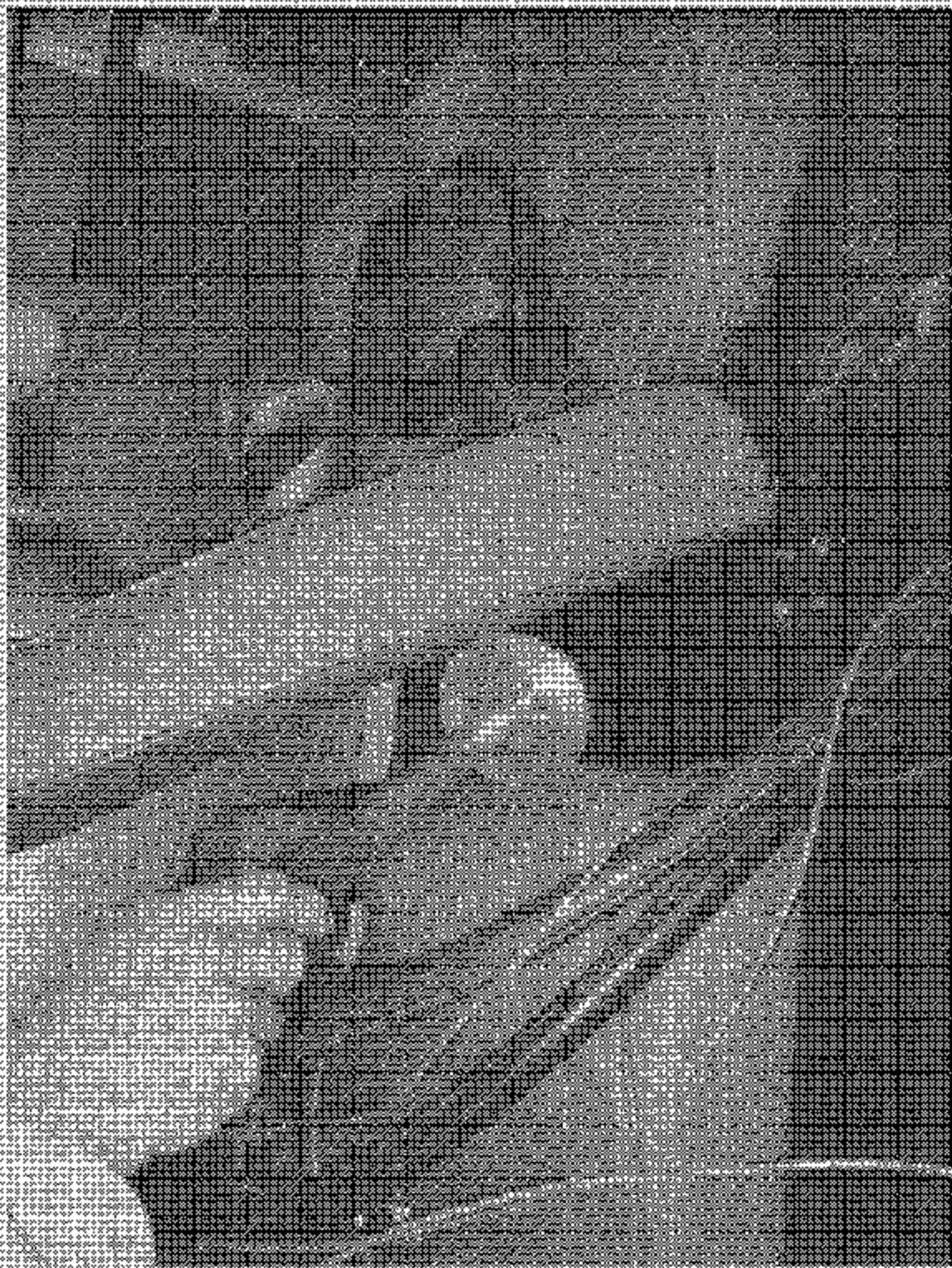


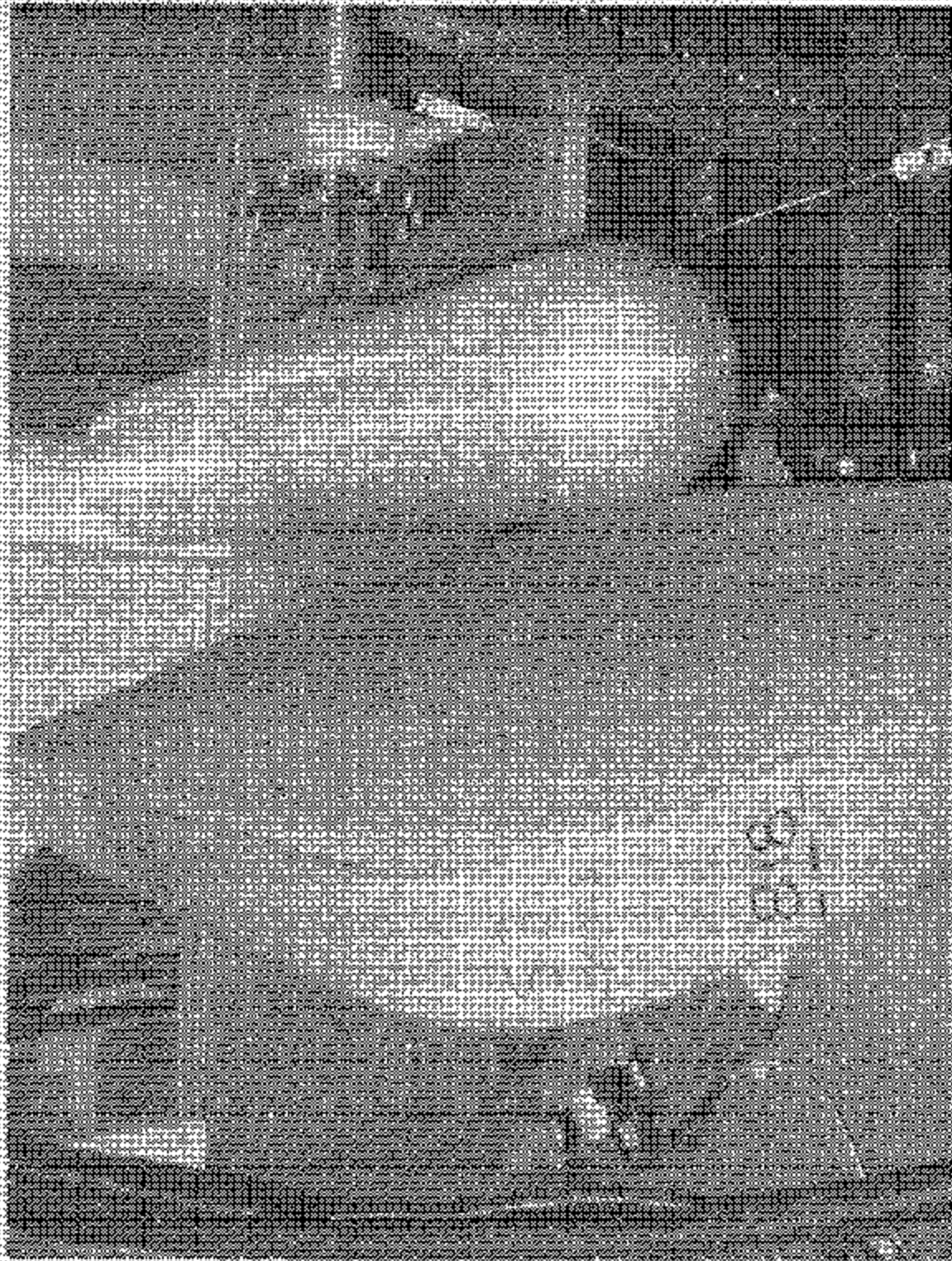


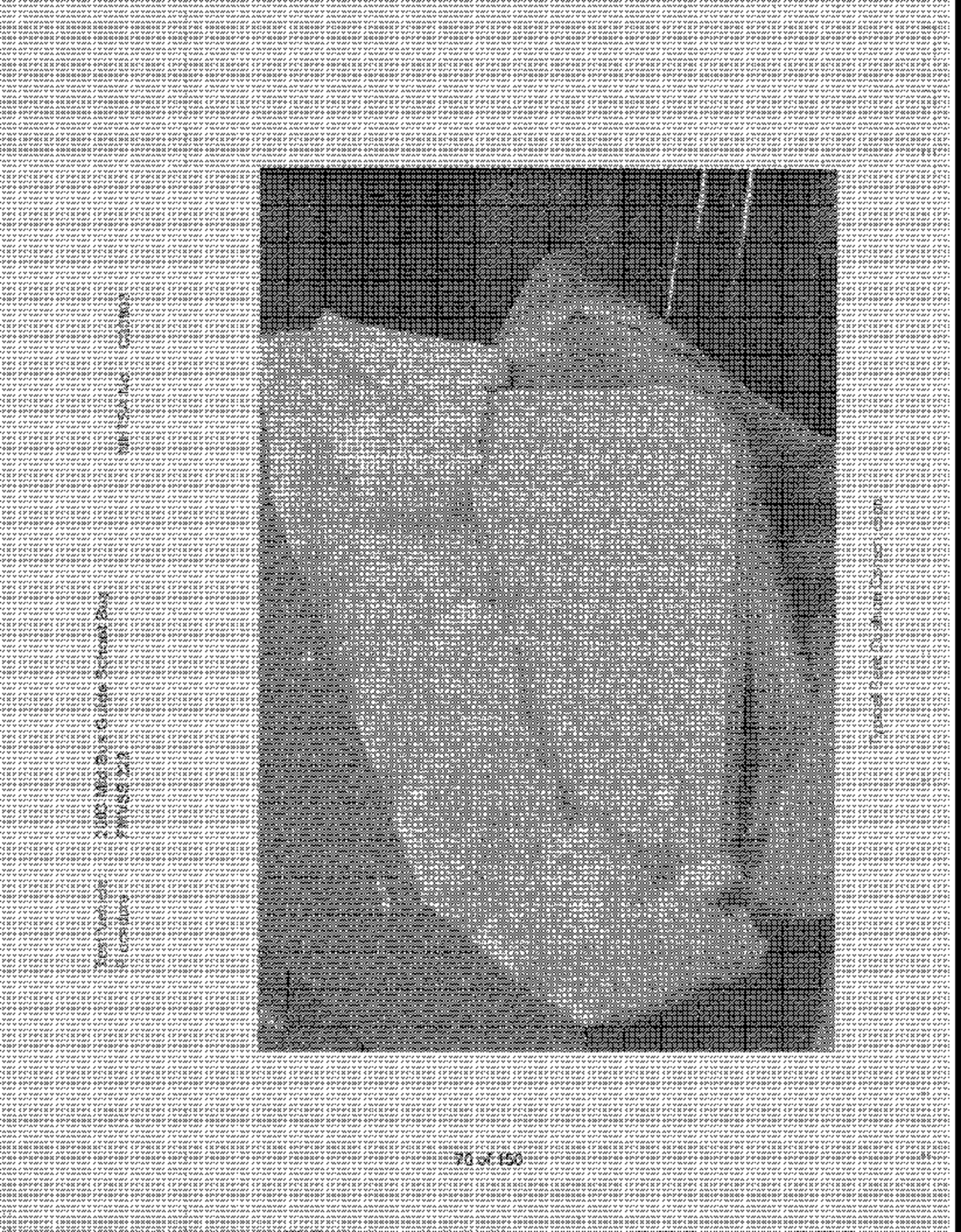


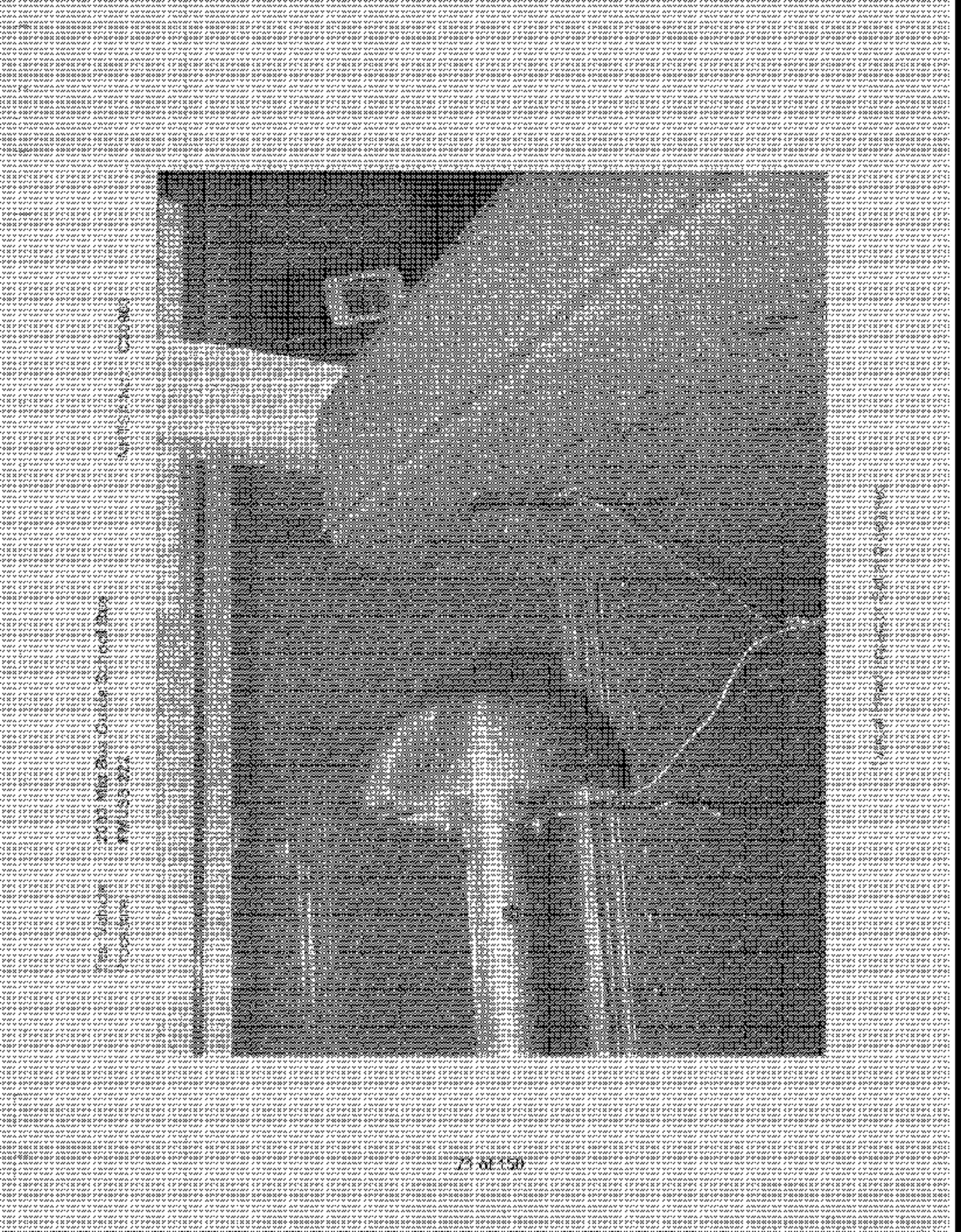


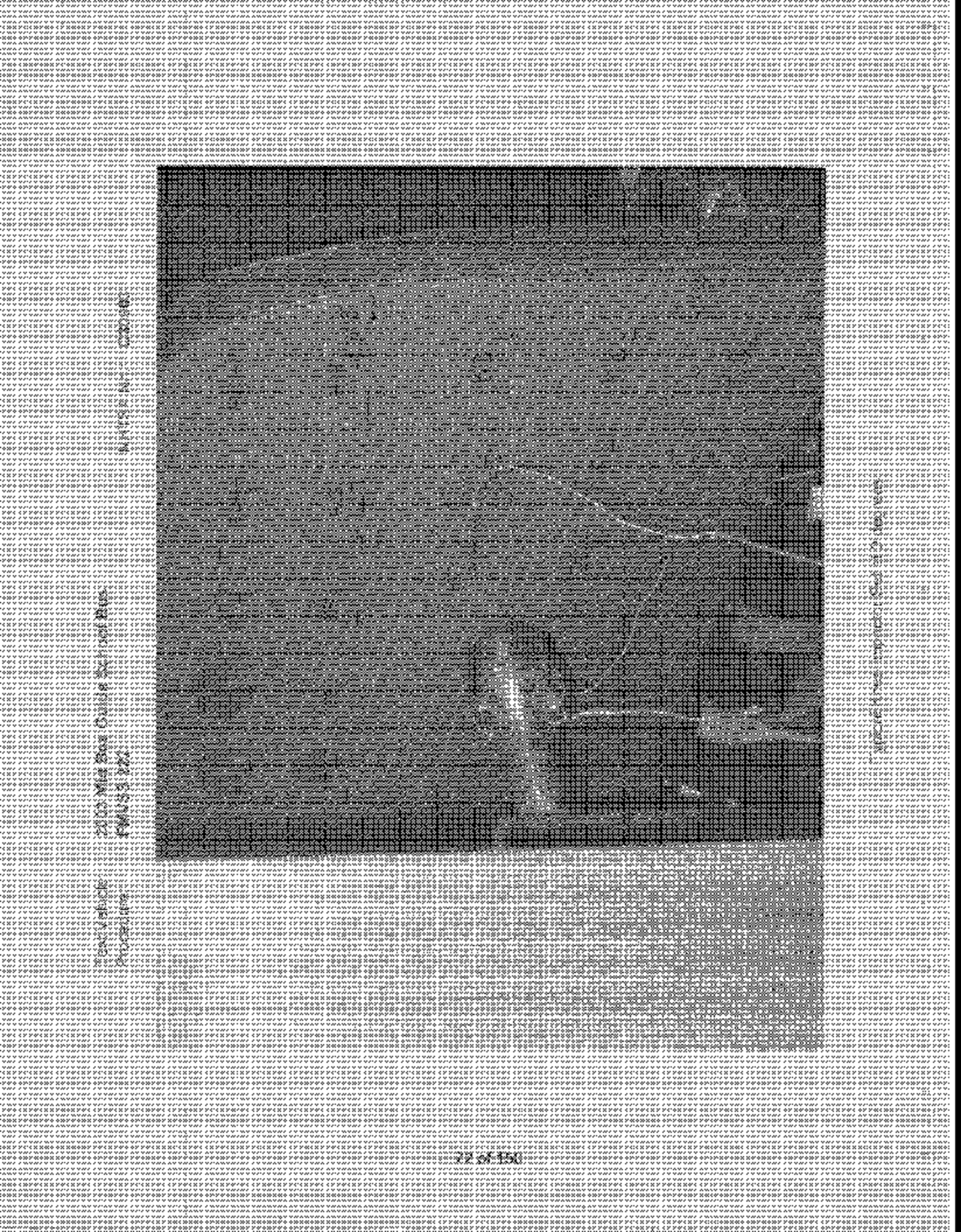


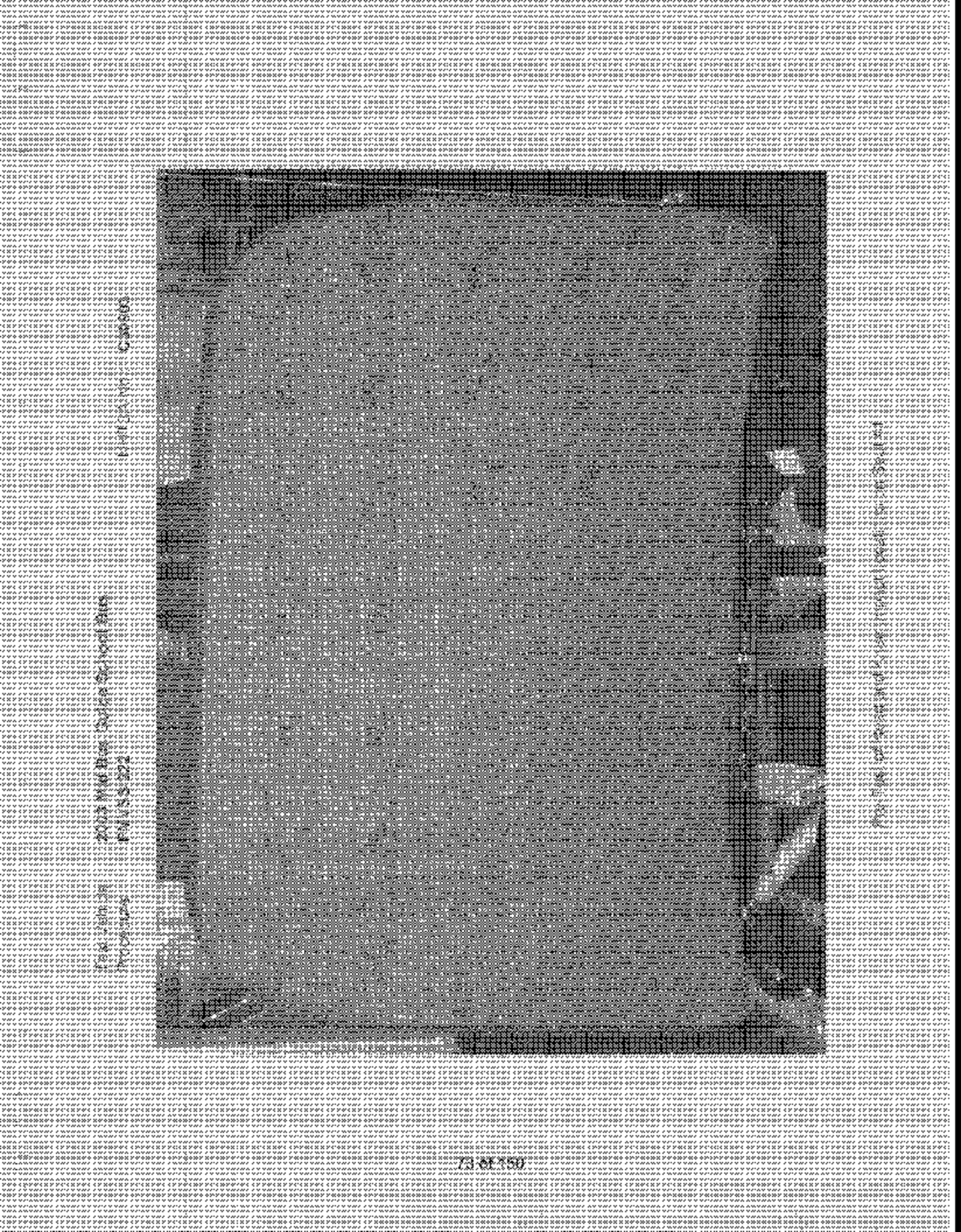


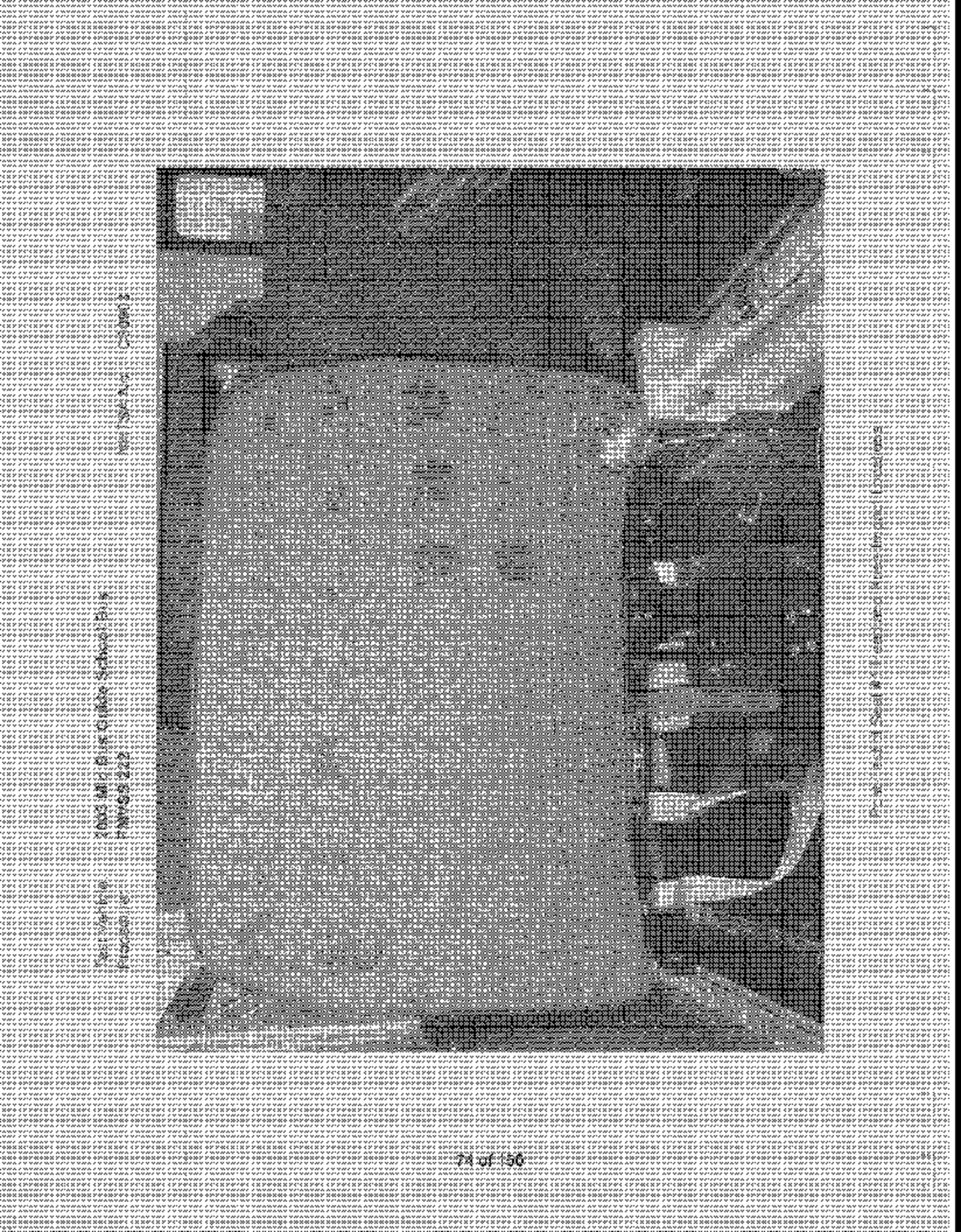




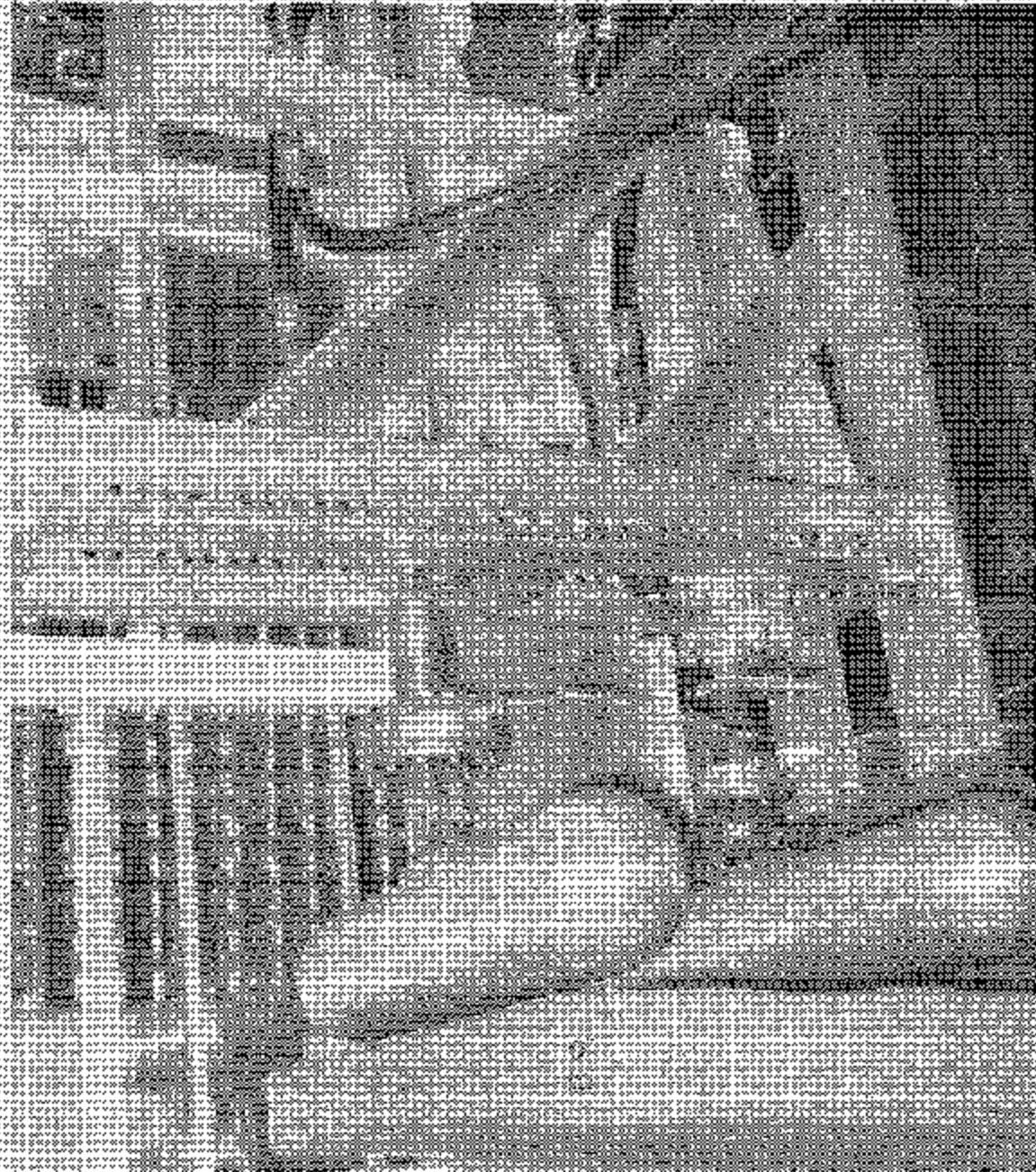






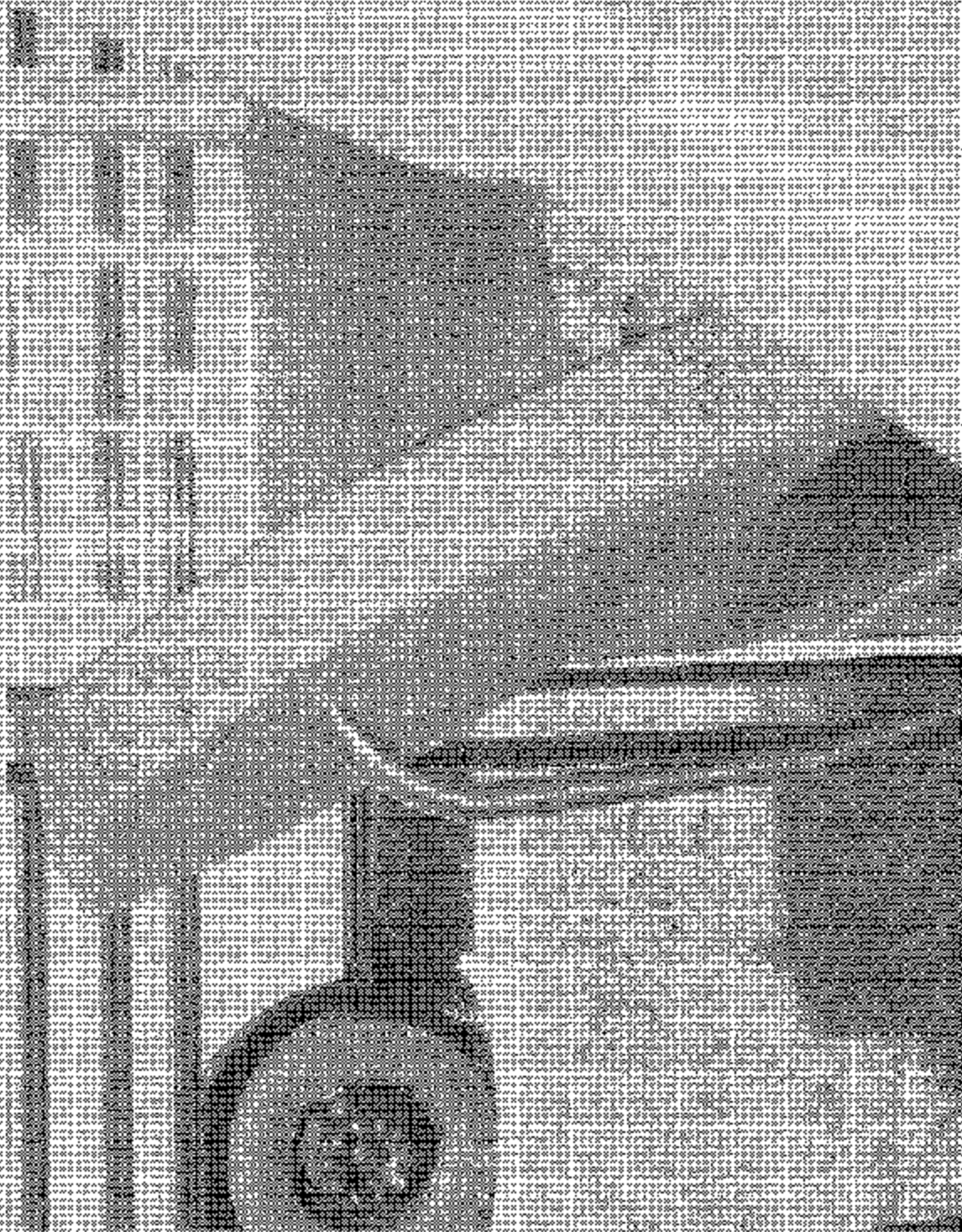


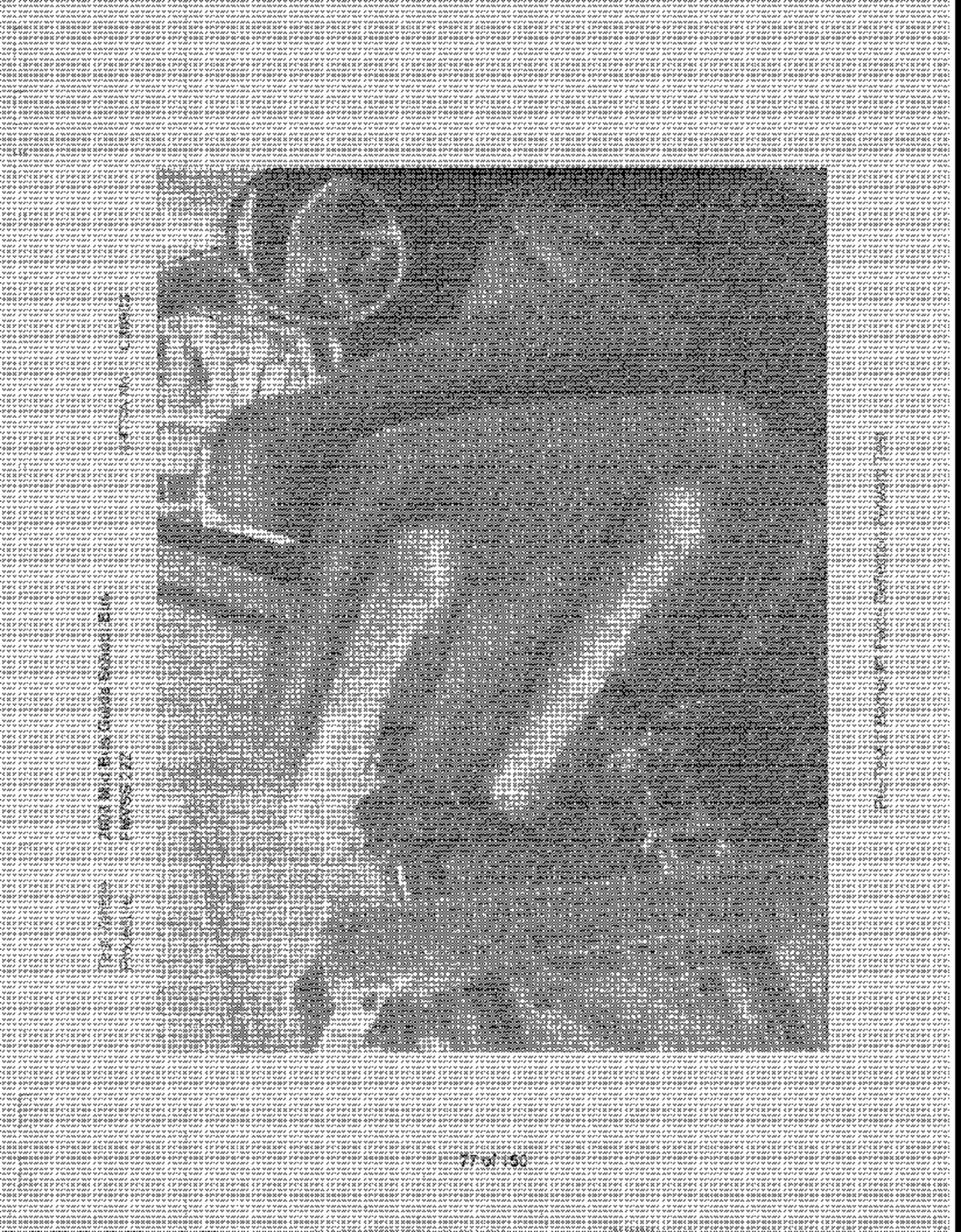
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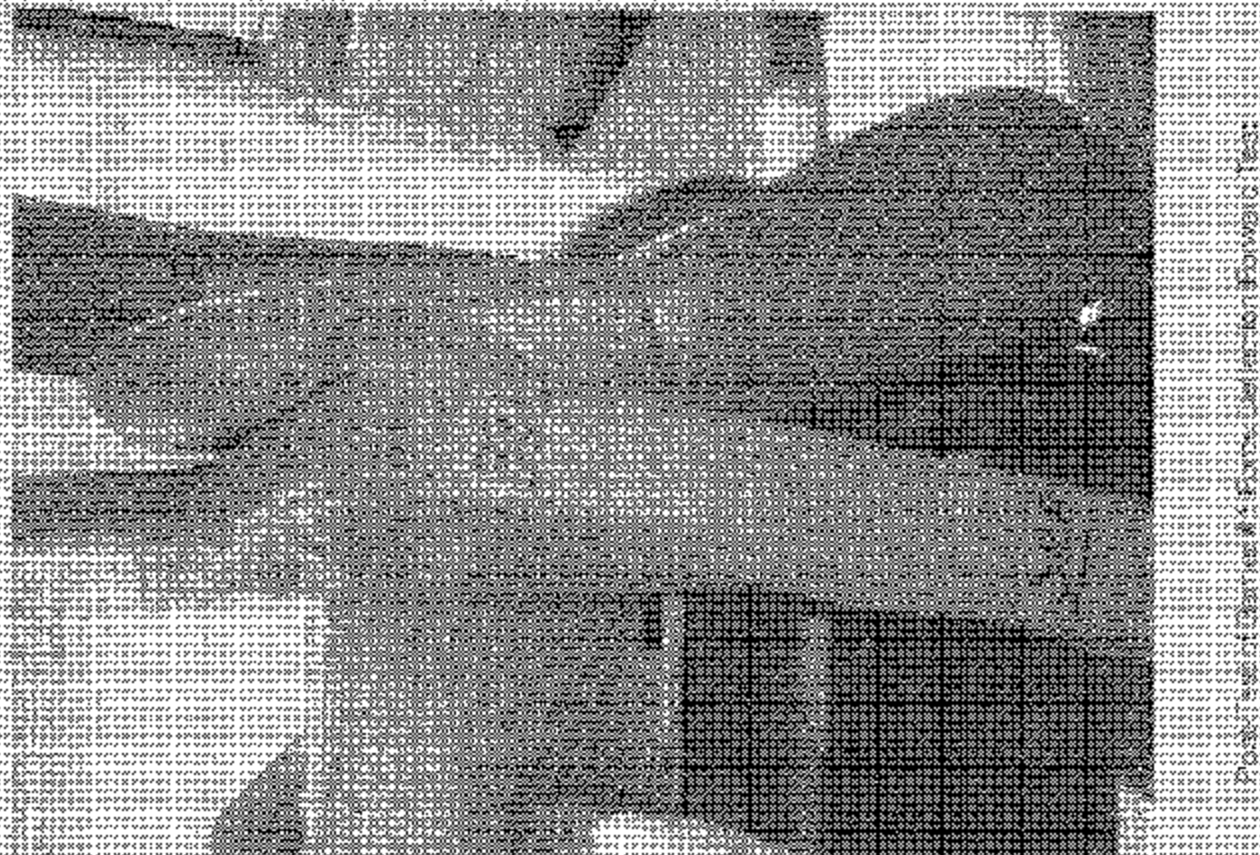
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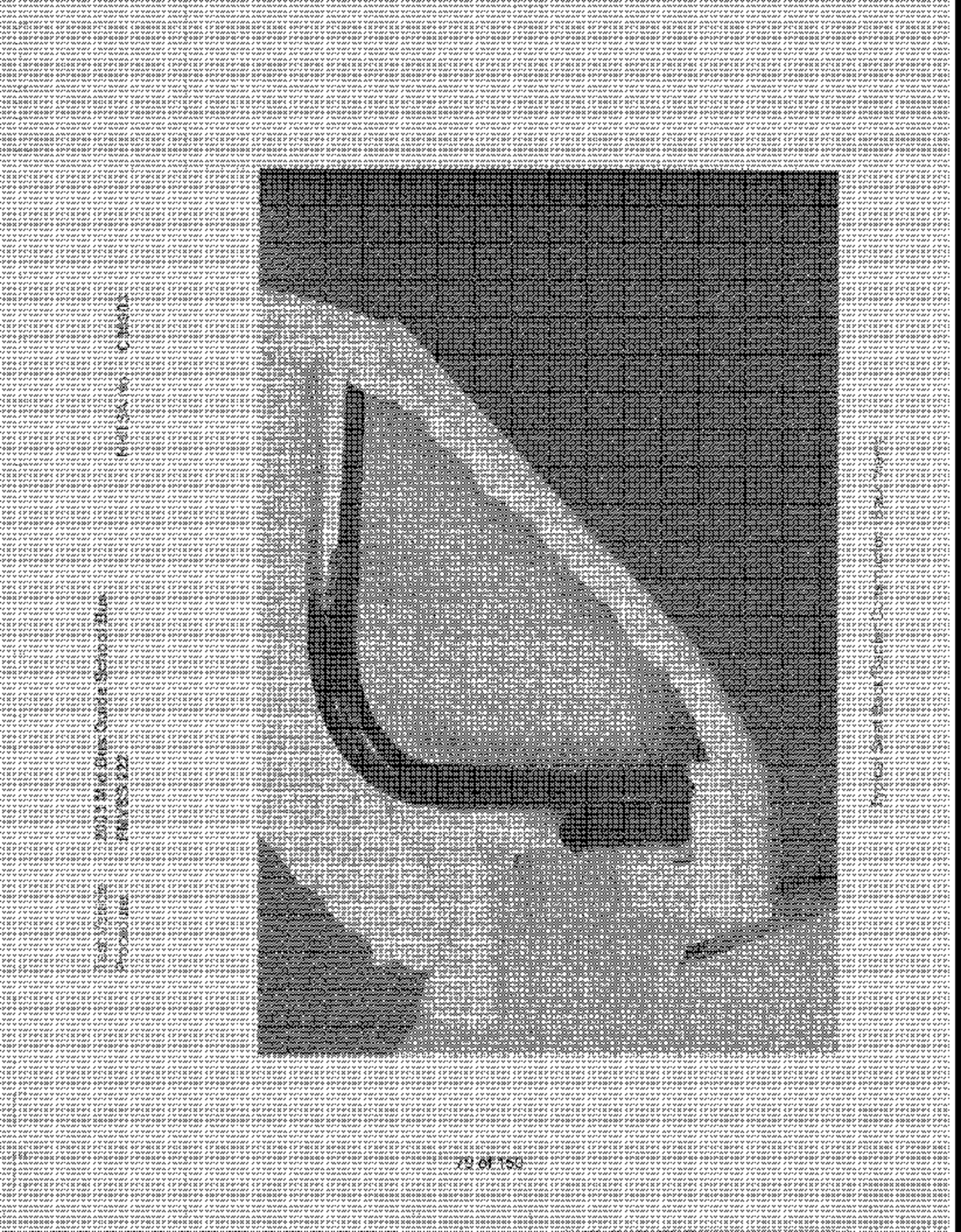


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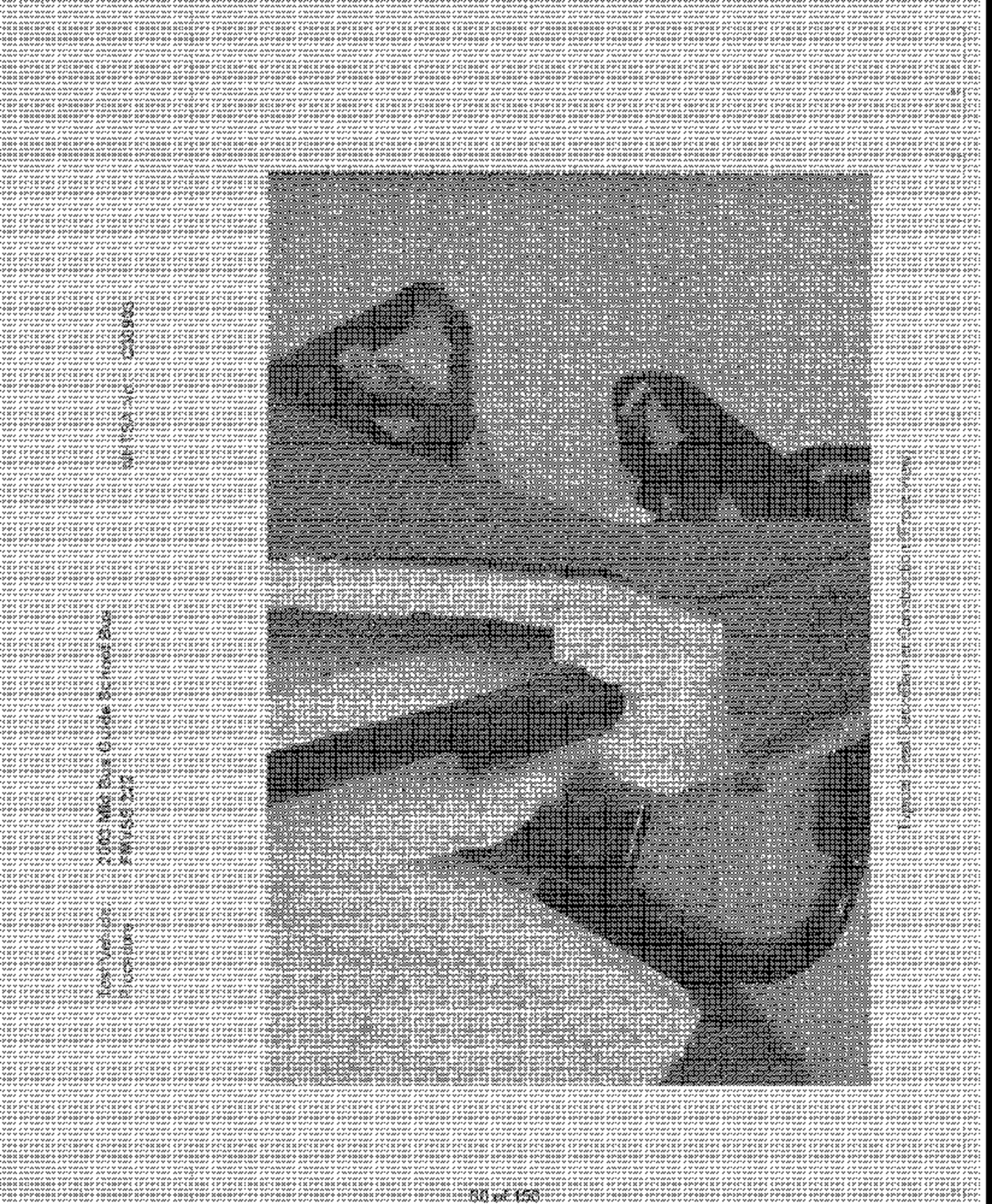
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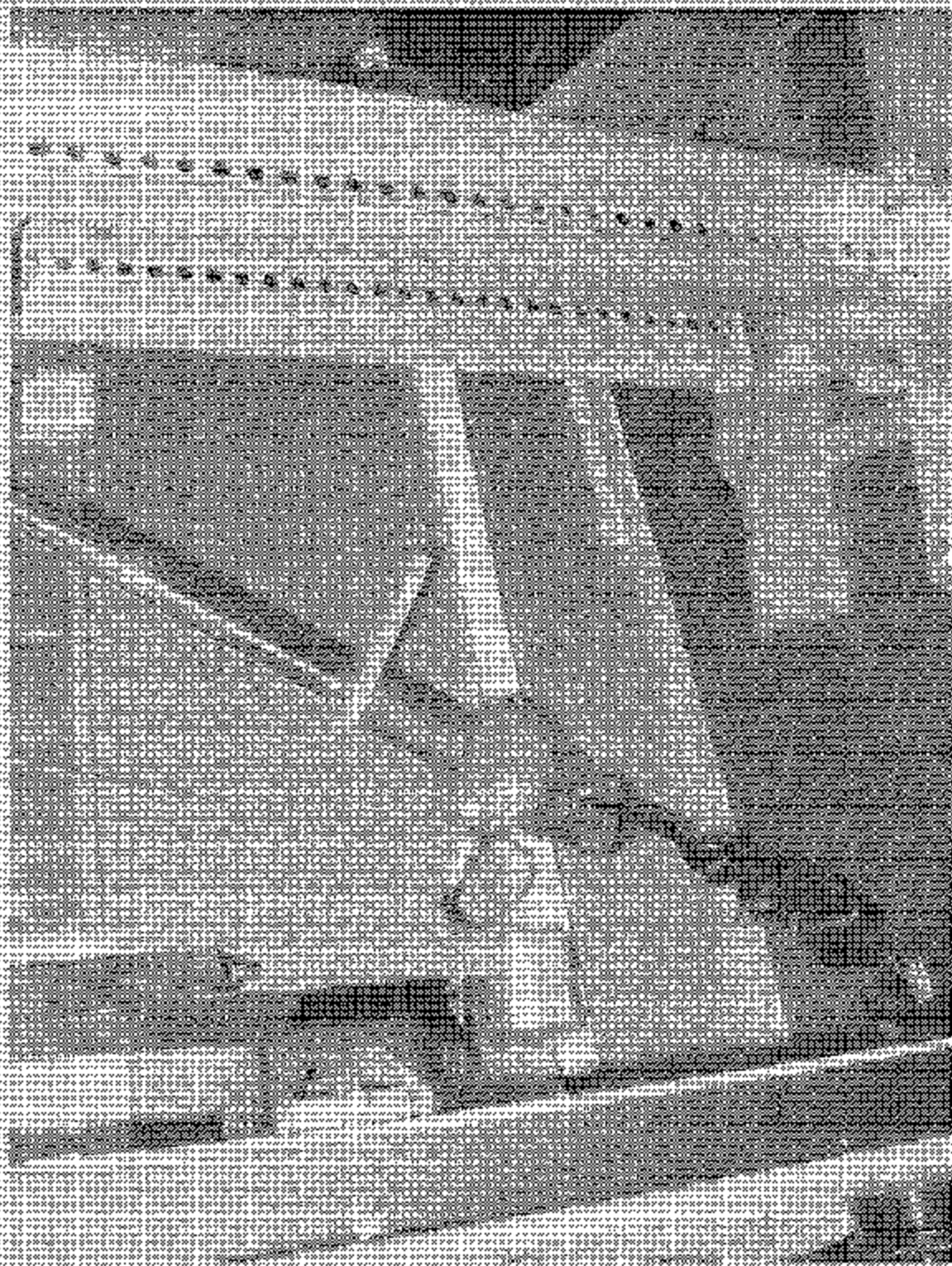
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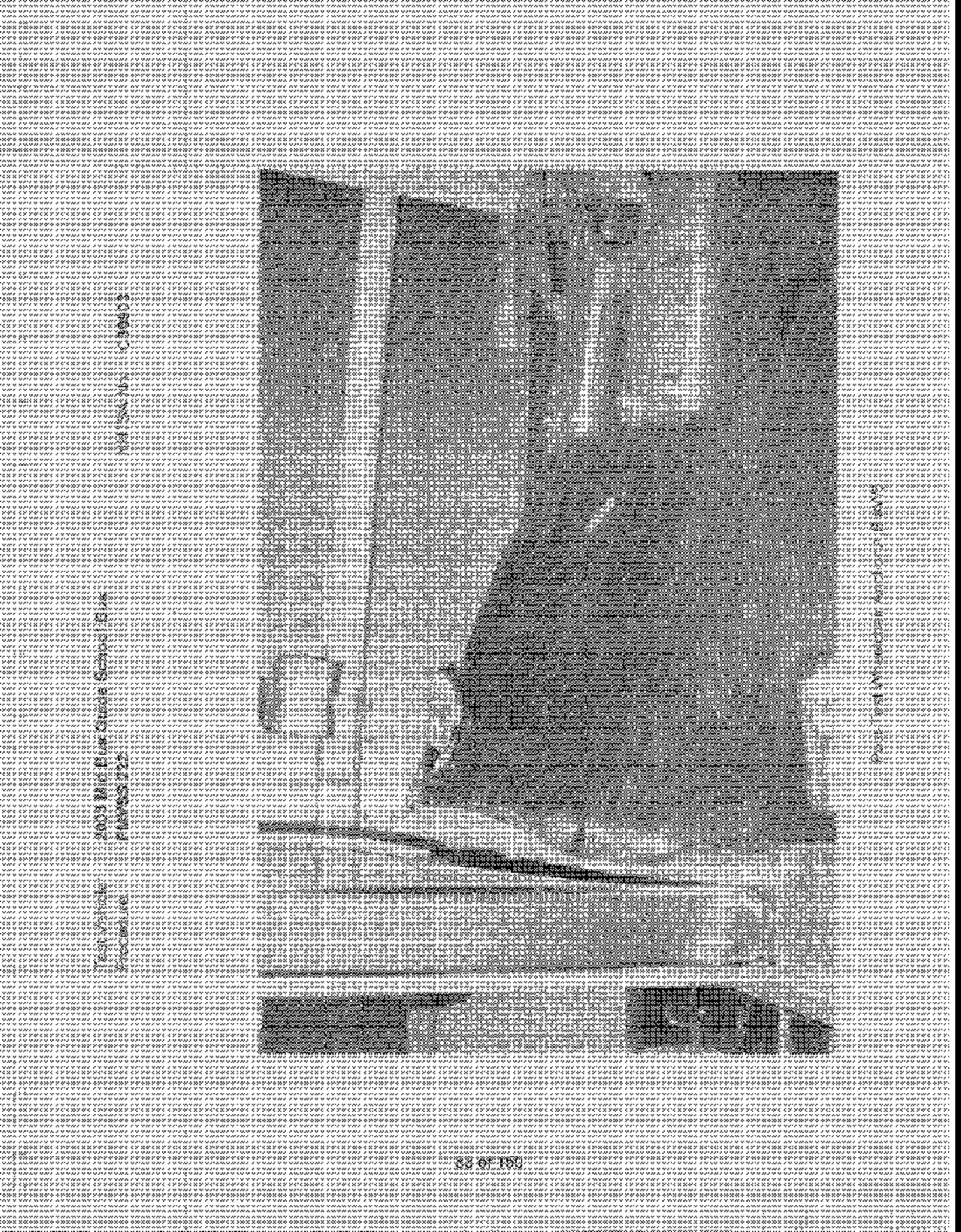
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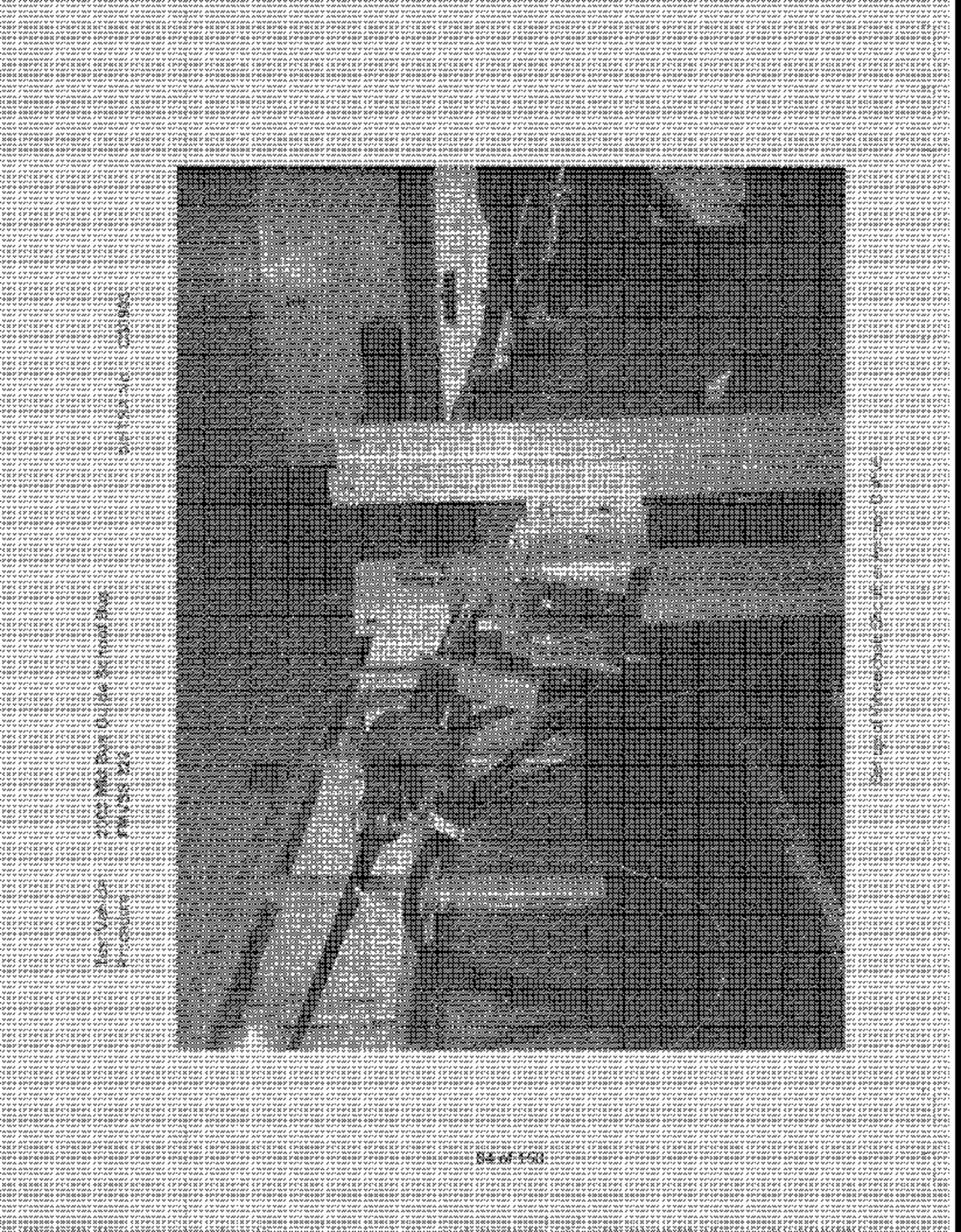
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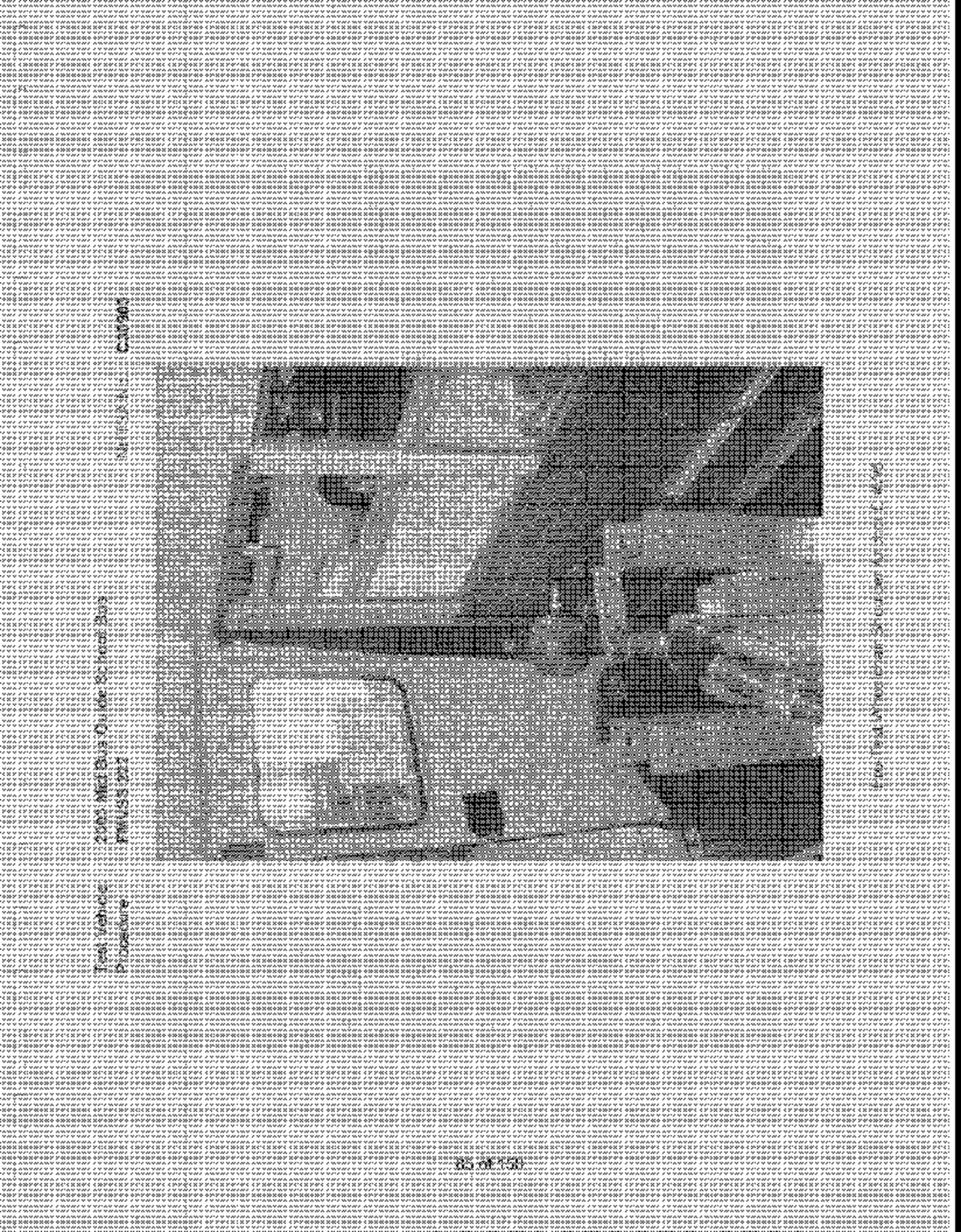














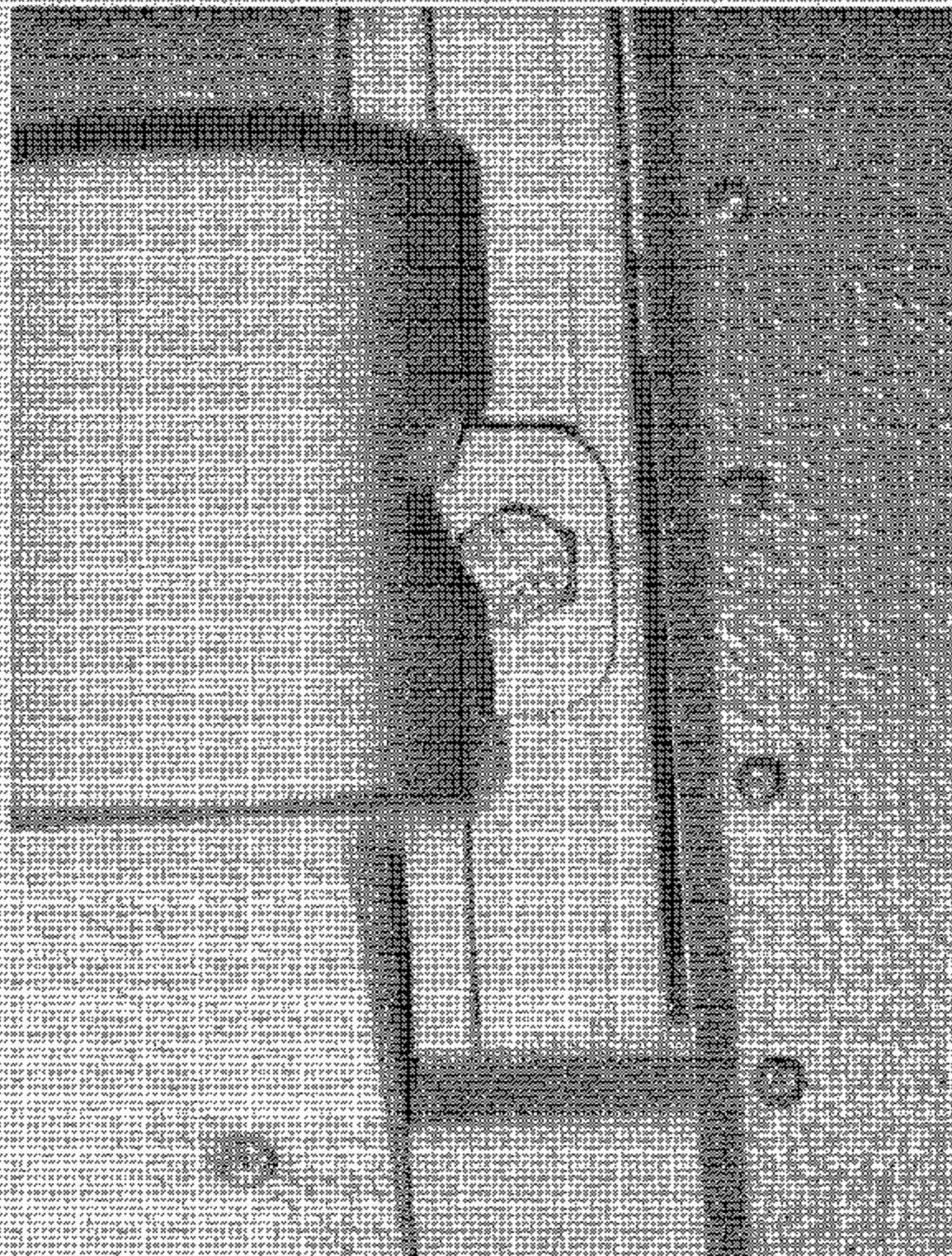
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PHOTOGRAPH

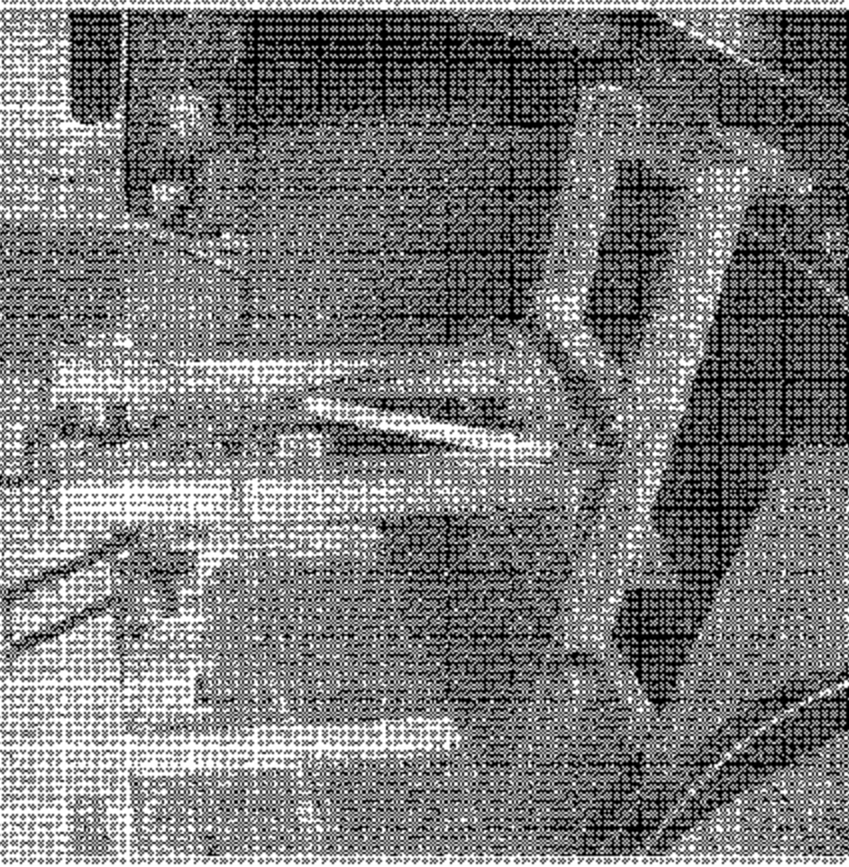
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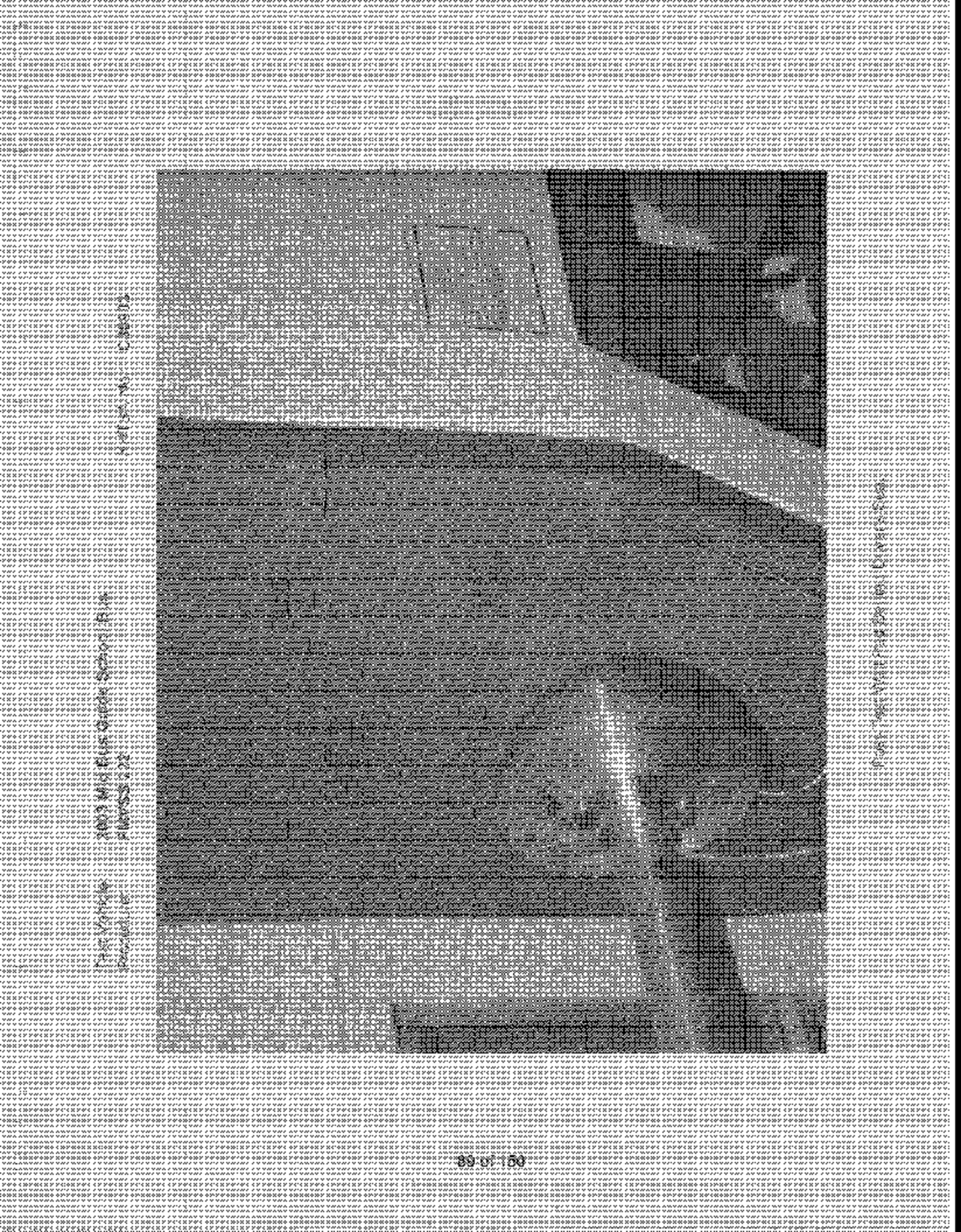
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tes, vehicle, and driver. The authors also noted that the use of a vehicle with a high level of automation may increase the risk of distraction, as the driver may become over-reliant on the vehicle's automation. This is a concern that is being addressed by researchers and regulators alike.

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Test Desc: S1 Cushion Retention

Component ID: Mid Bus

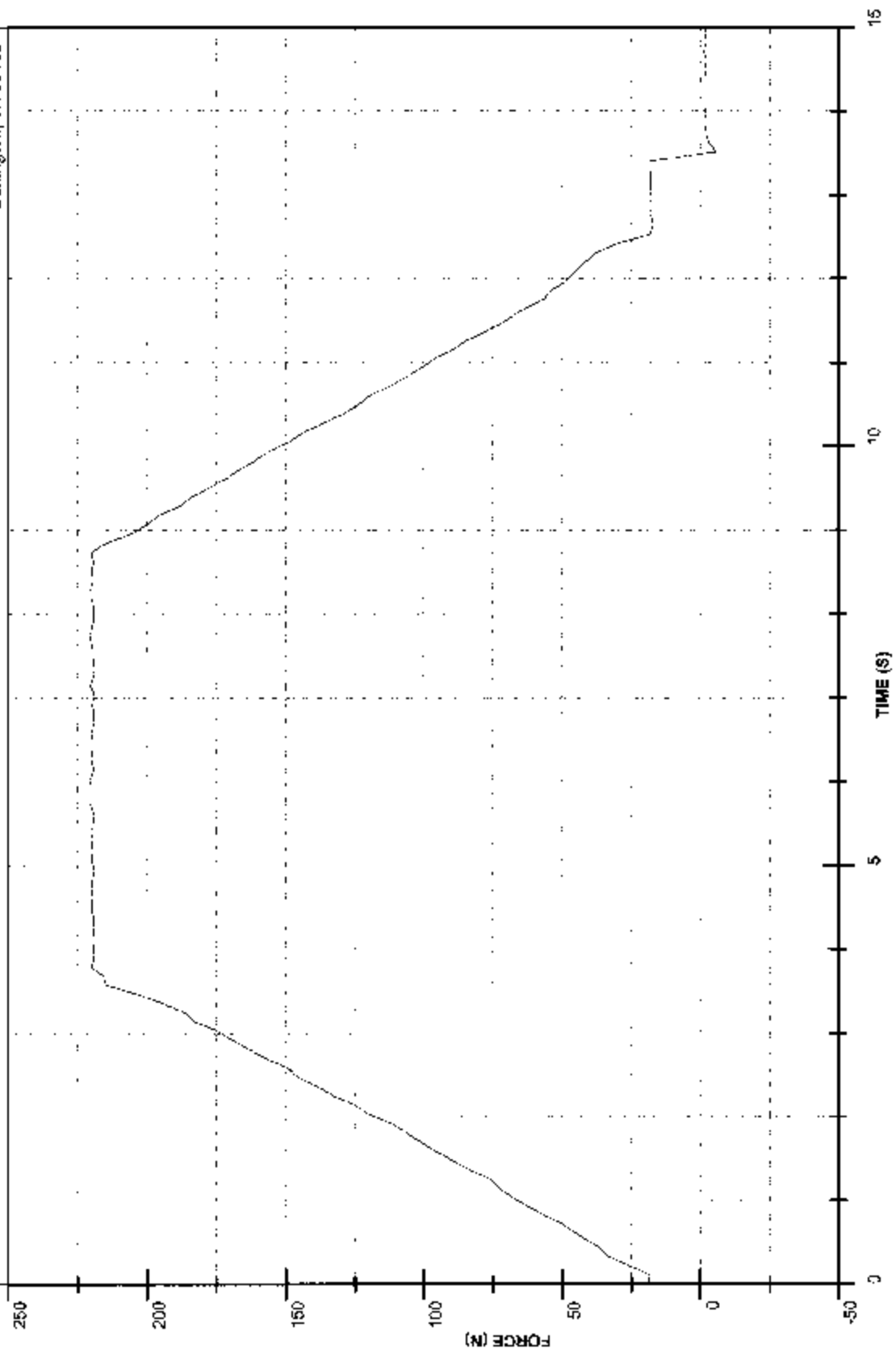
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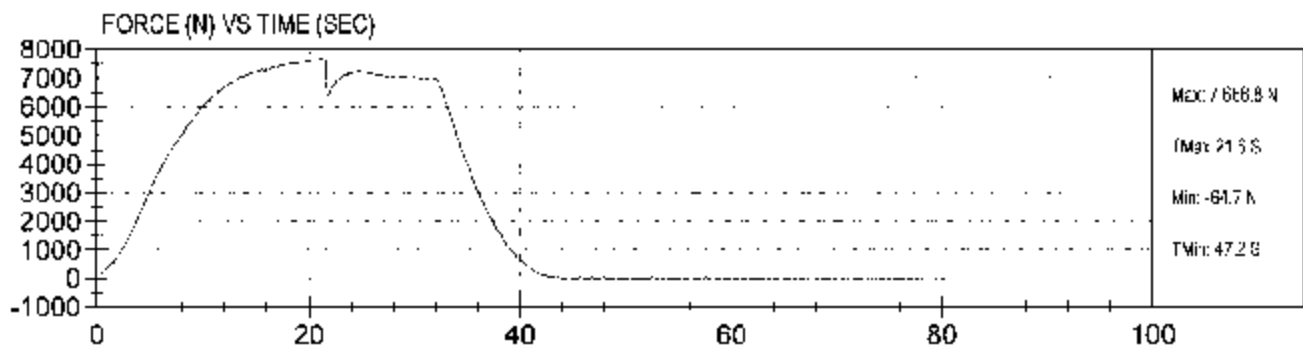
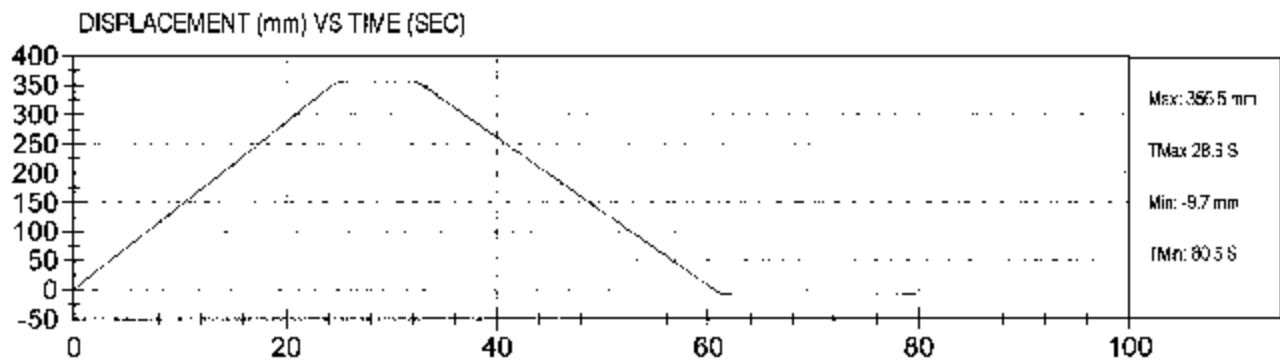
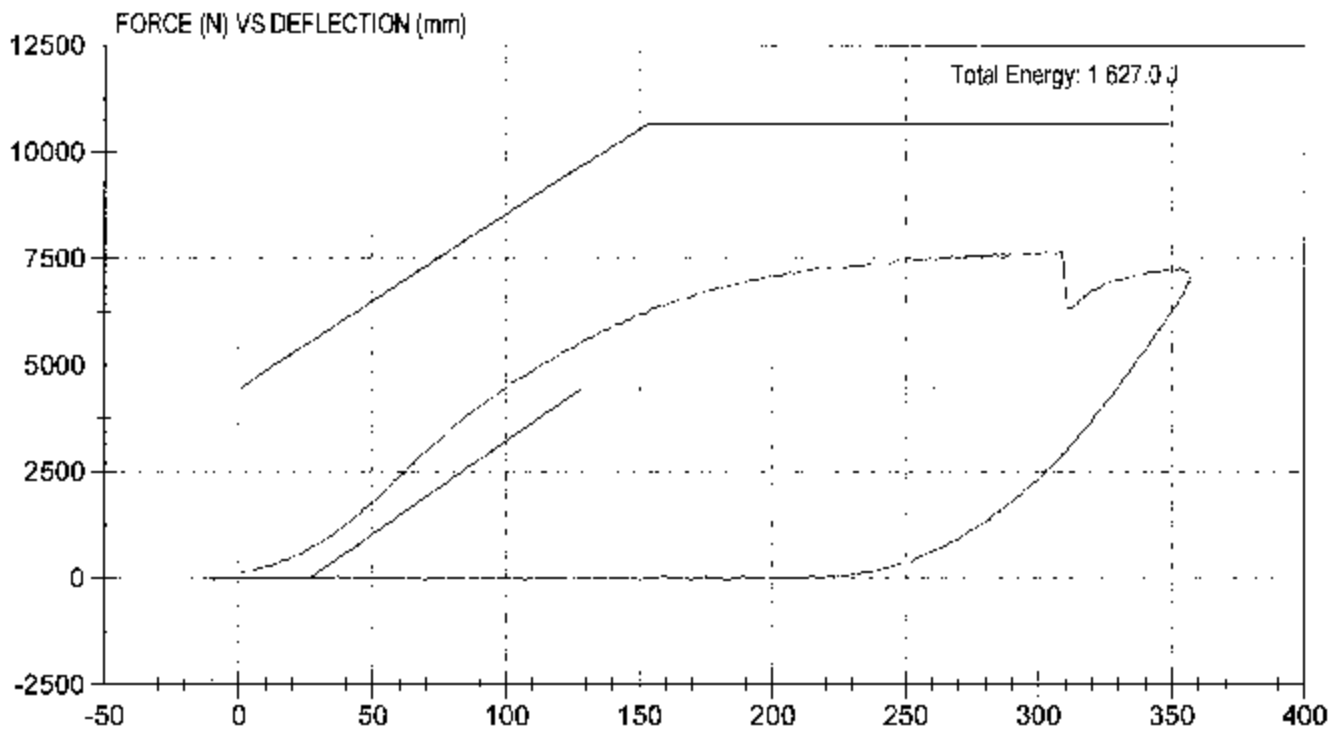
NHTSA #: C30903

MGA Research Corp

5000 Warren Road,

Burlington, WI 53105



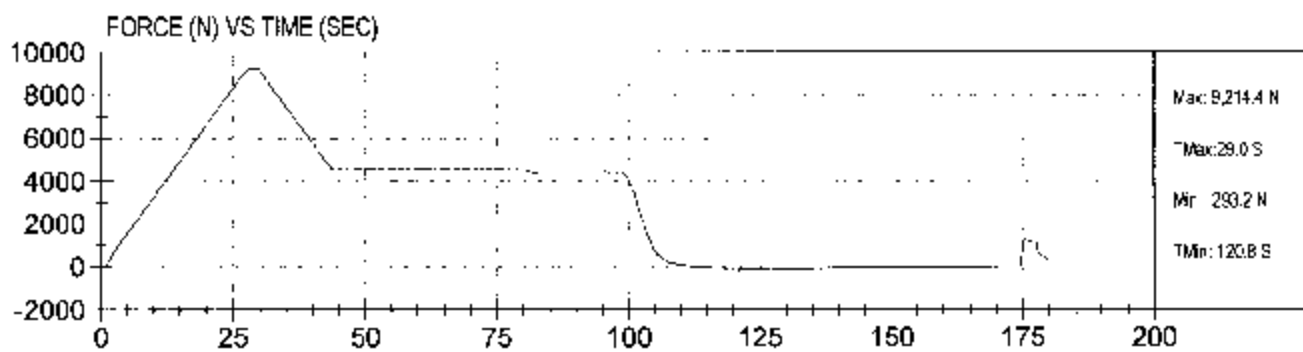
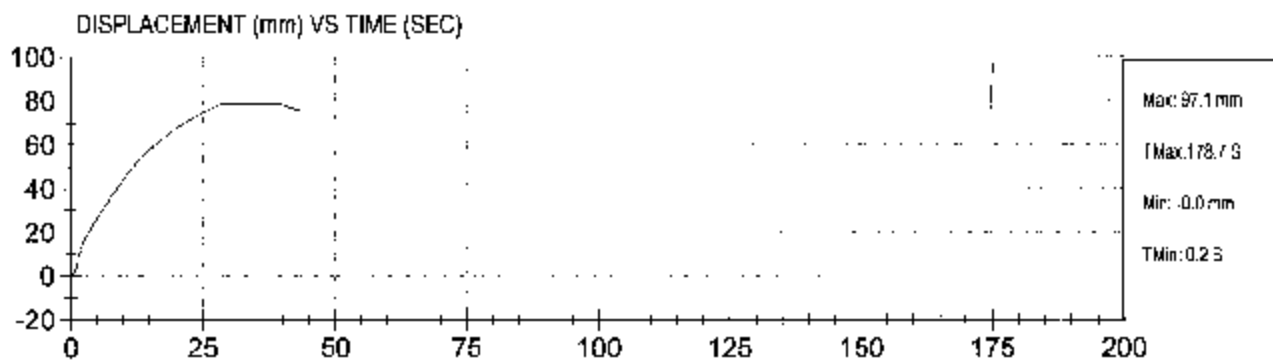
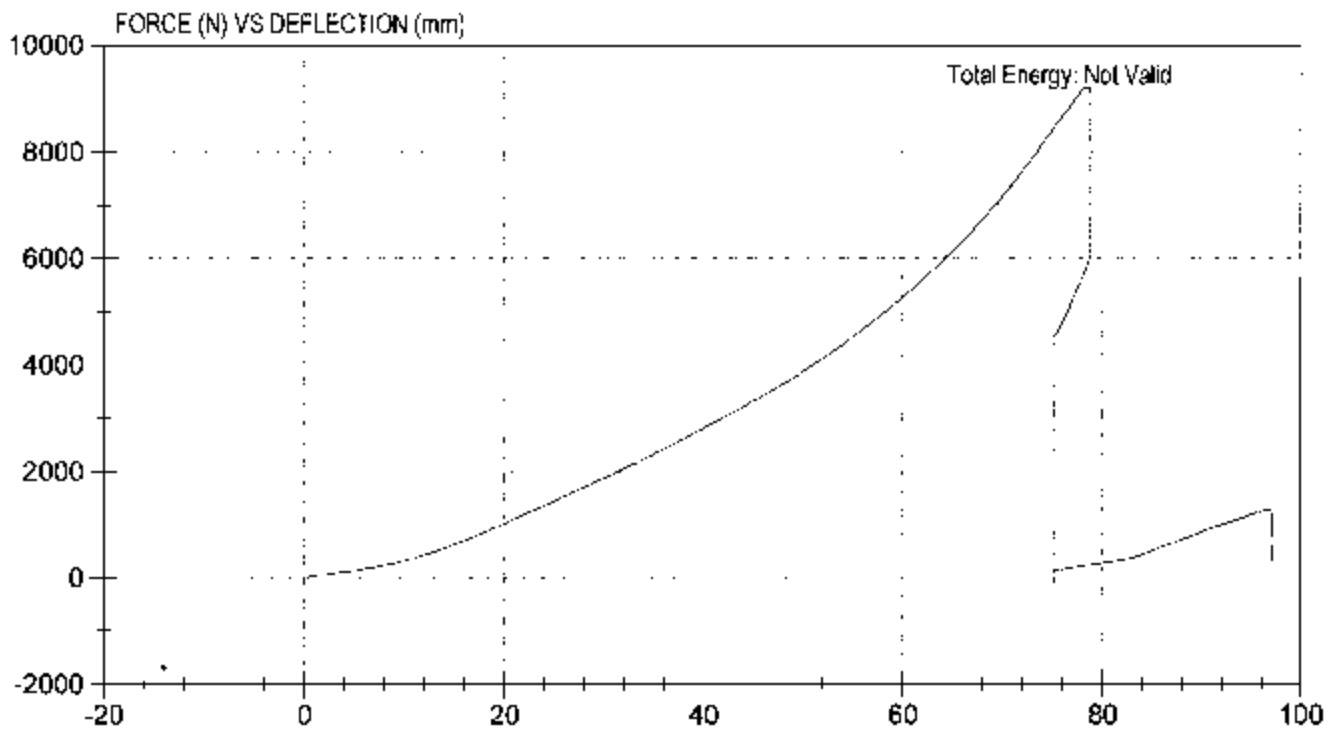
**mga**Test Desc: S6 Forward Deflection Upper
Component ID: Mic BusTest Date: 6-10-03
NHISA #: C30903



mga

Test Desc: S6 Lower
Component ID: Mid Bus

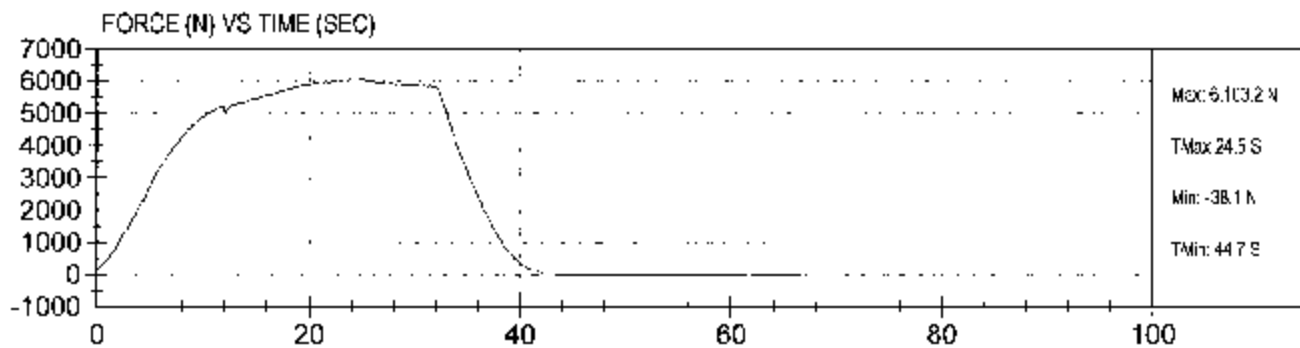
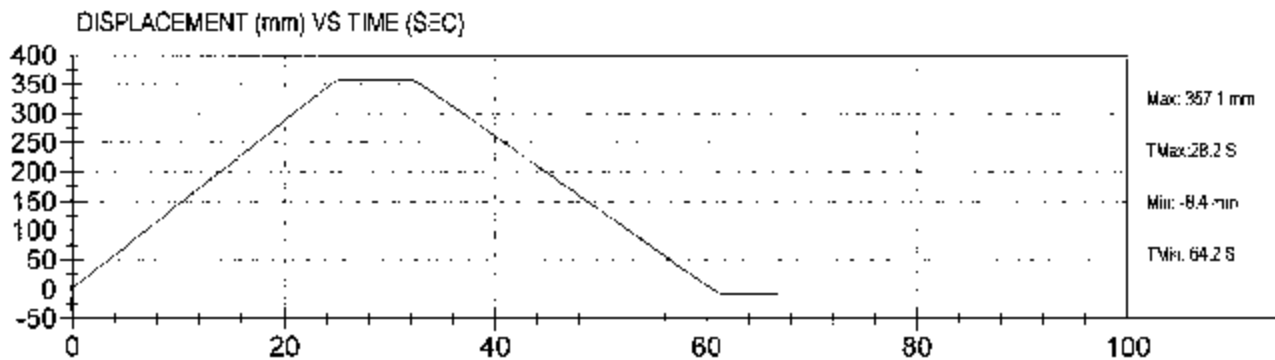
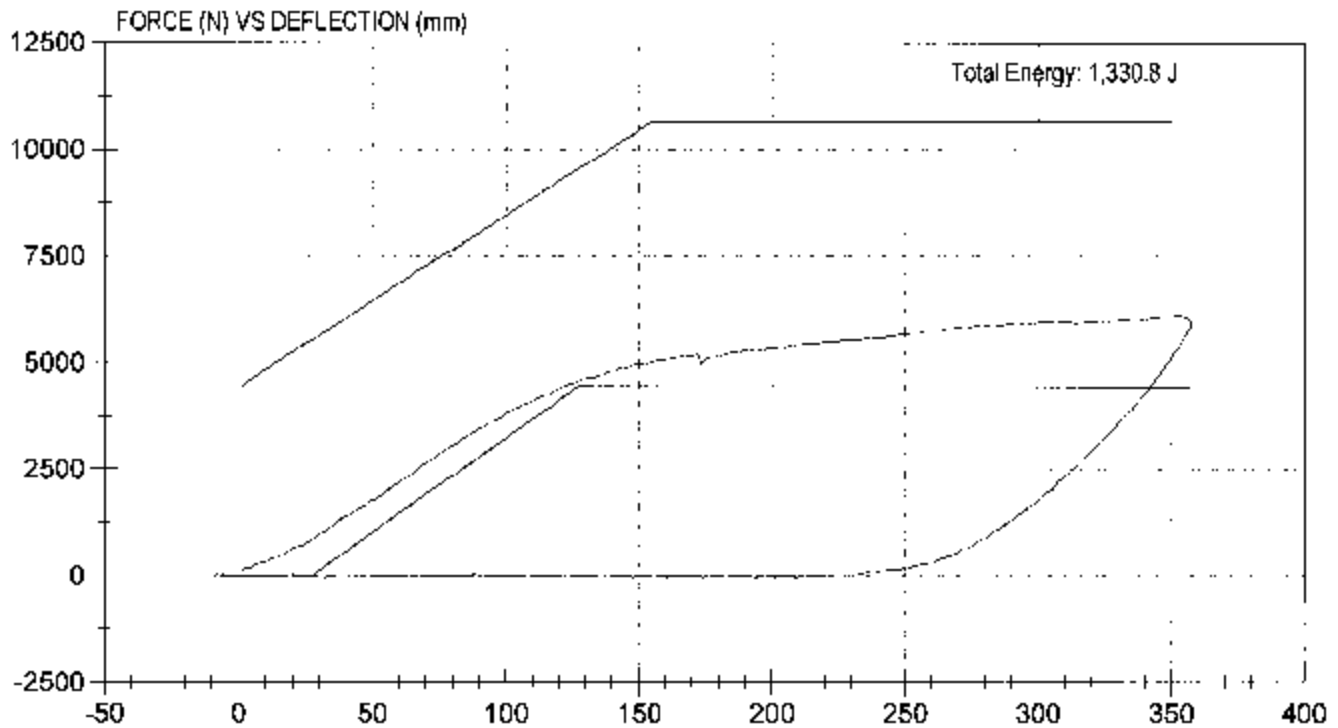
Test Date:
NHTSA #: C30903





Test Desc: S7 Forward Deflection Upper
Component ID: Mid Bus

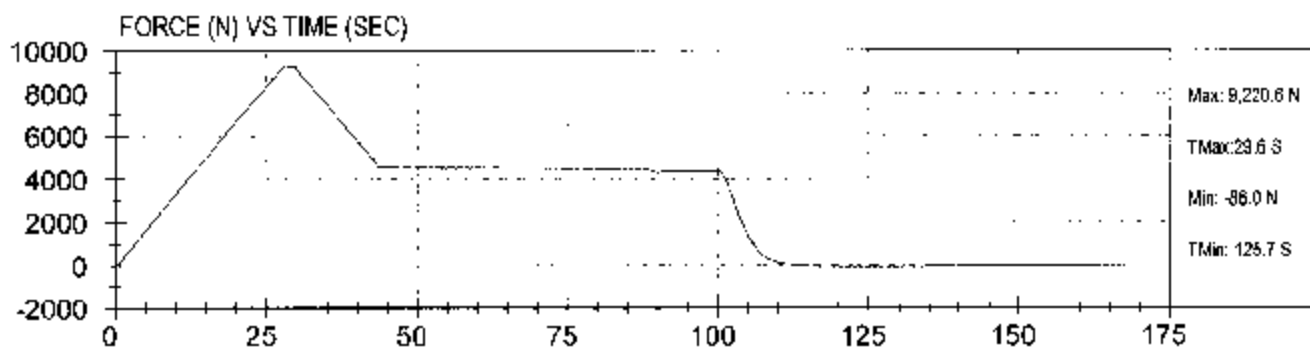
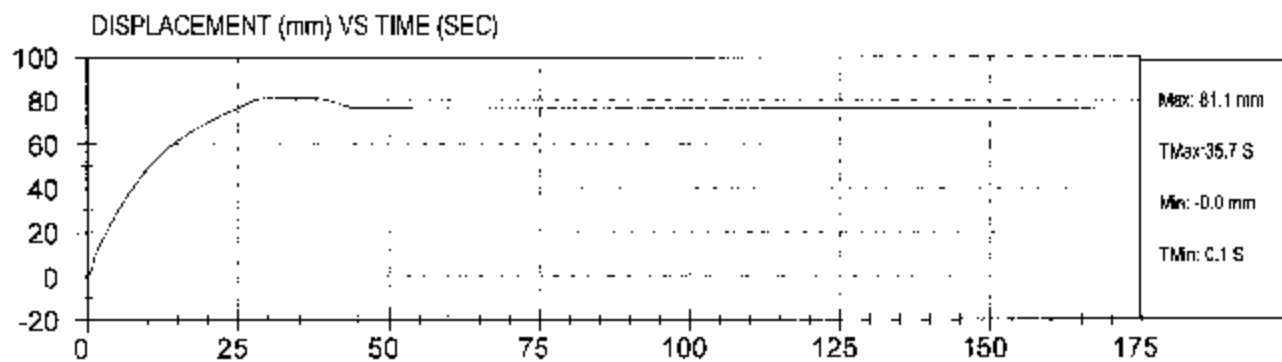
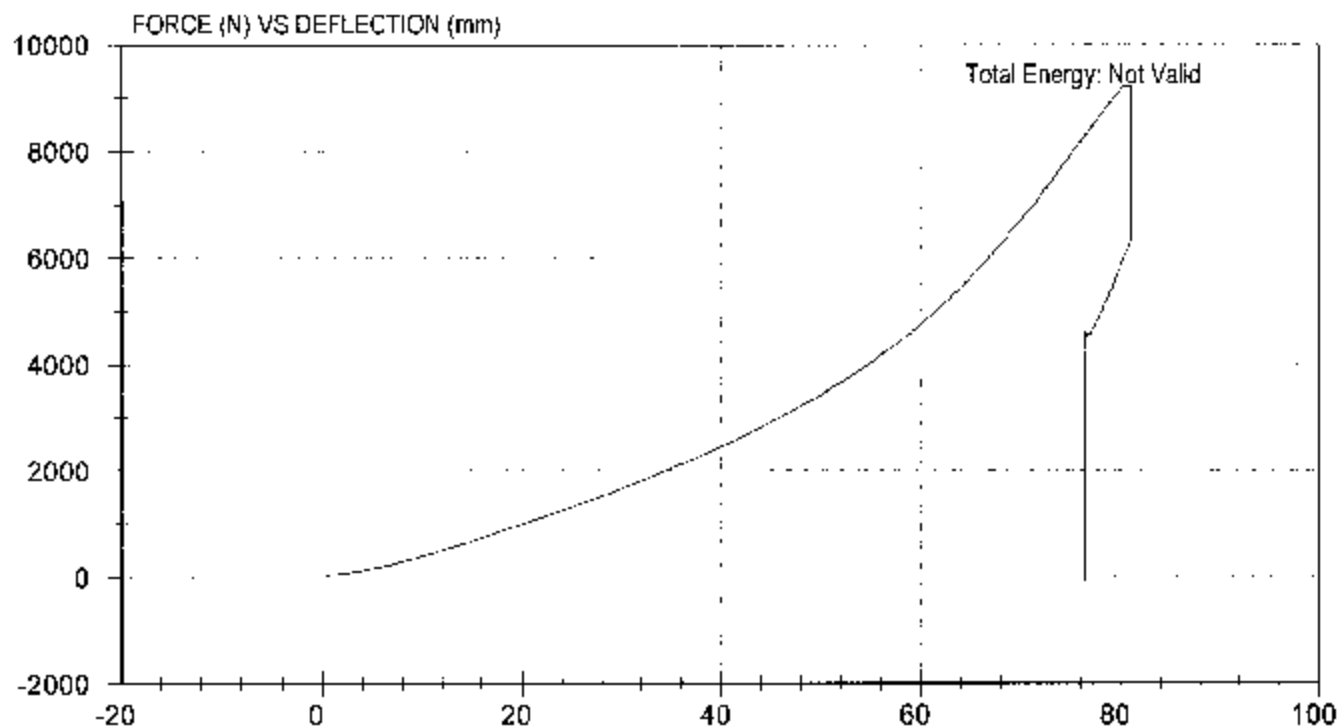
Test Date: 6-20-03
NHTSA #: C30903

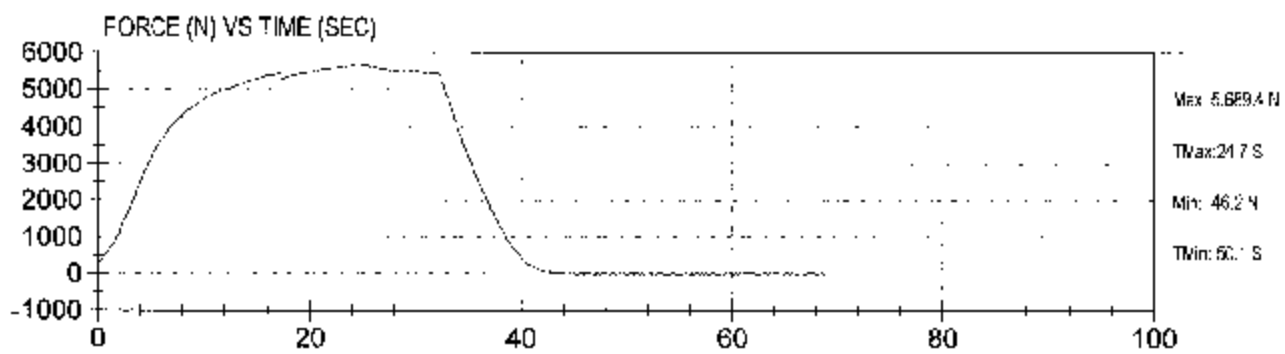
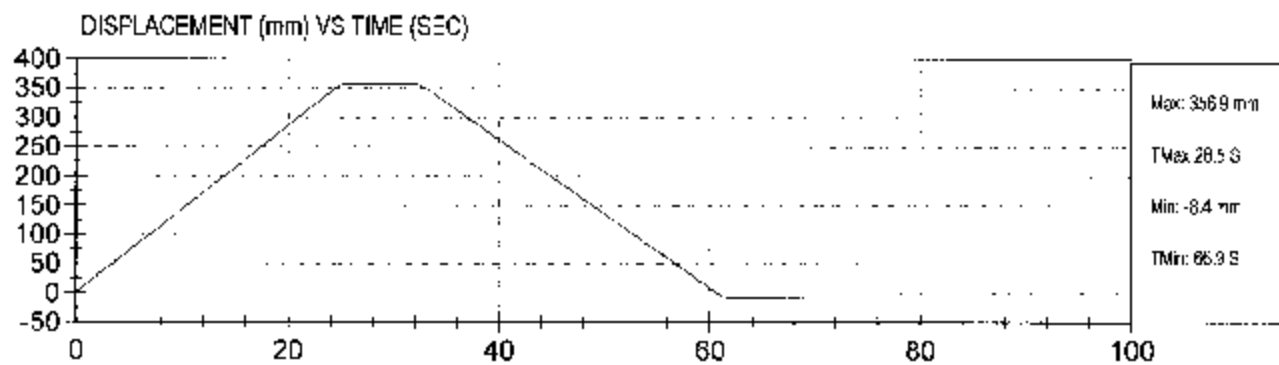
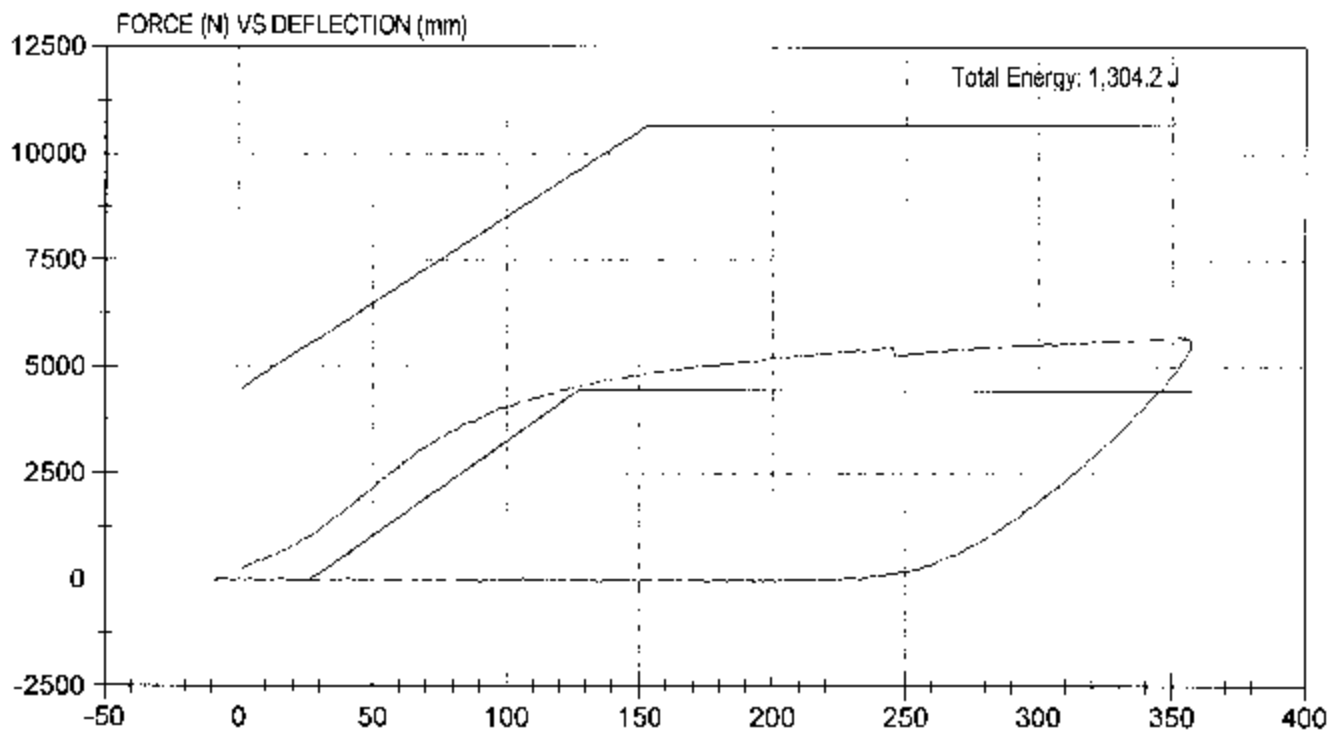




Test Desc: S7 Lower
Component ID: Mid Bus

Test Date: 6/20/03
NHTSA #: C30903

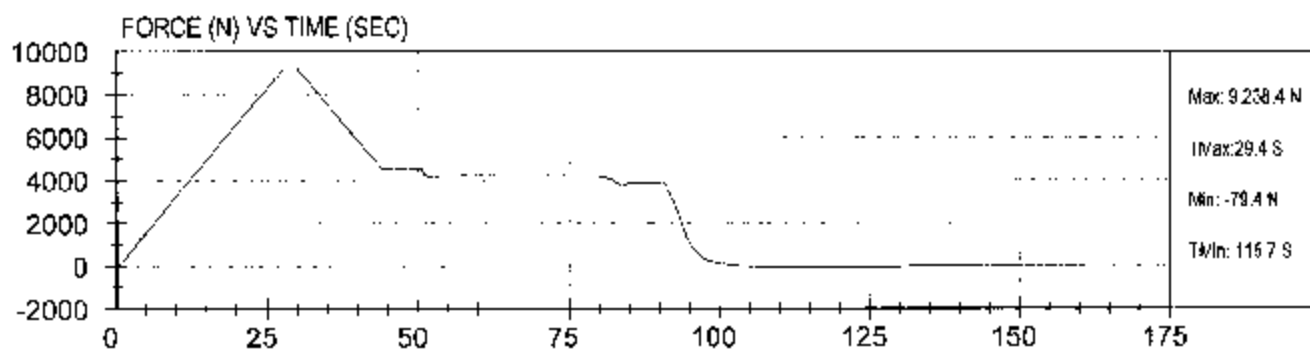
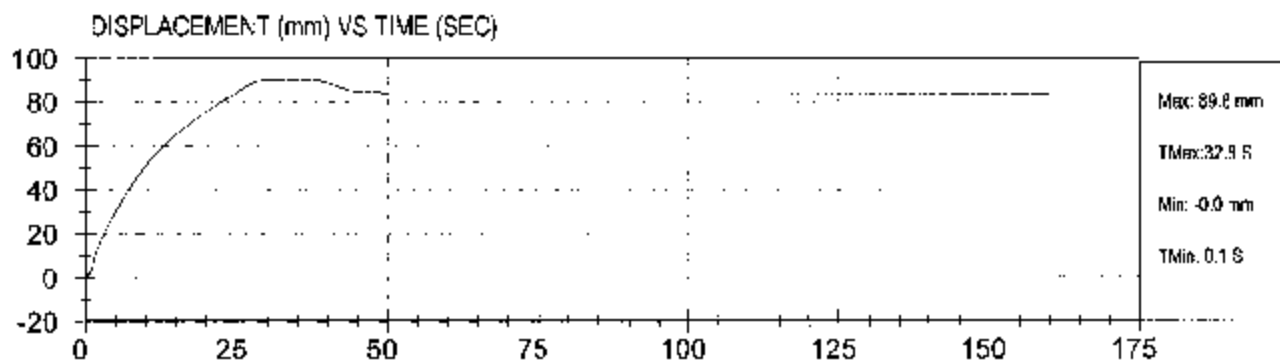
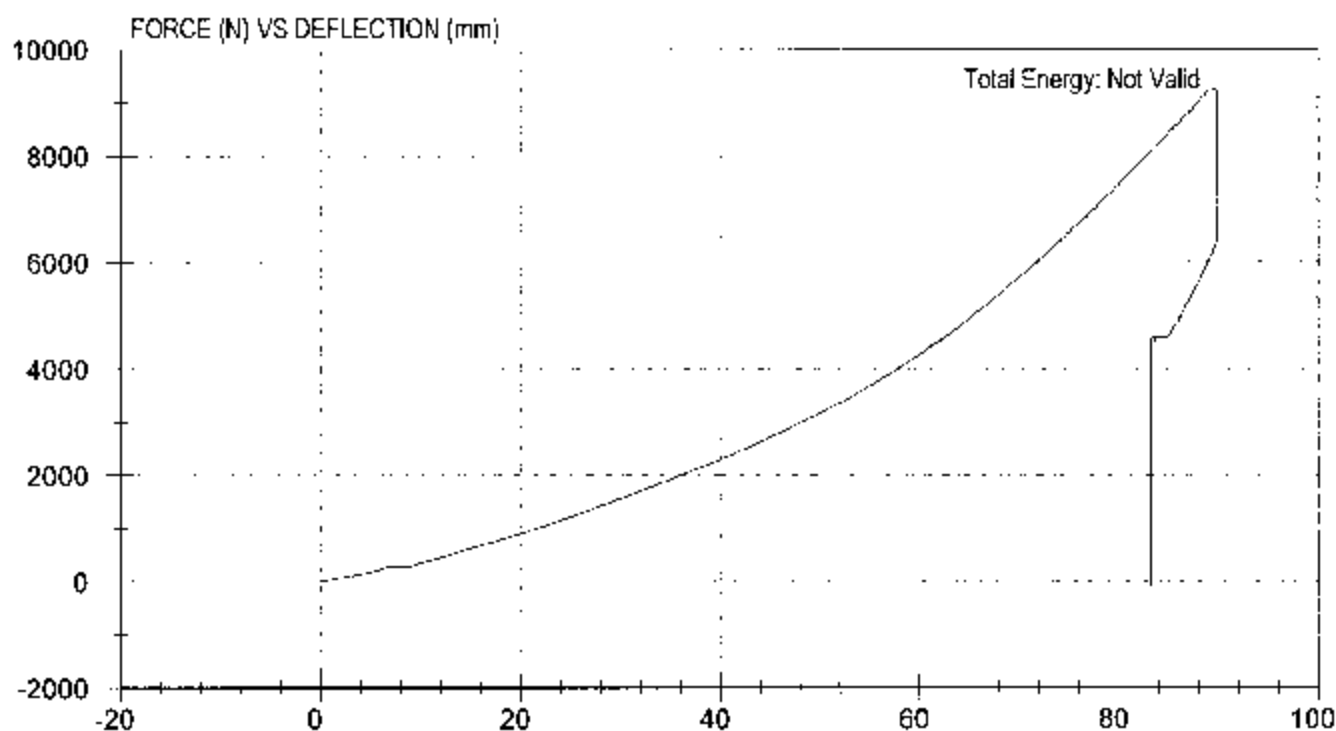


**mga**Test Desc: S& Forward Deflection Upper
Component ID: Mid BusTest Date: 6-9-03
NHTSA #: C3C9D3



Test Desc: S9 Lower
Component ID: Mid Bus

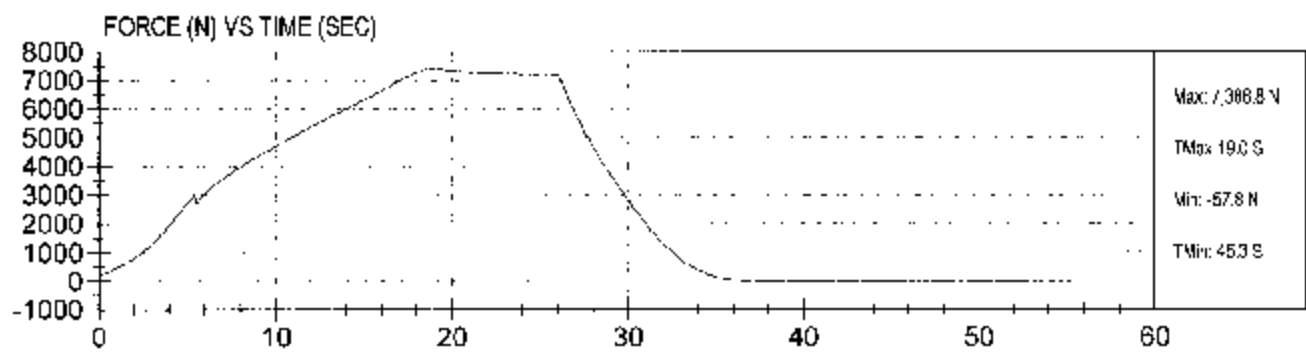
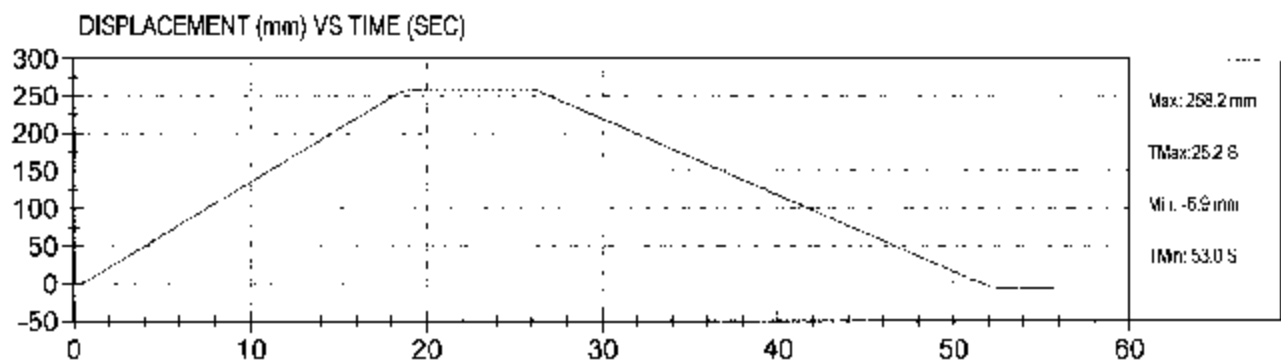
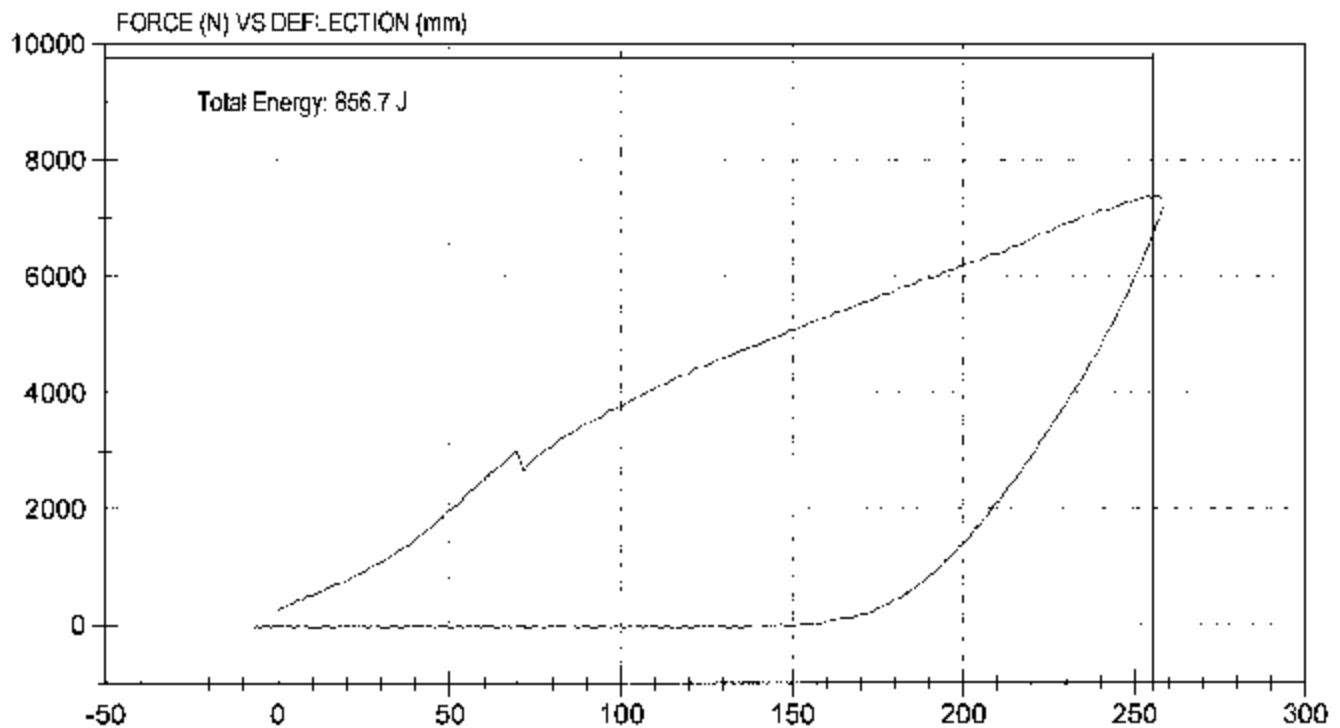
Test Date: 6/9/03
NHTSA #: C30903





Test Desc: SEAT REARWARD S2 in S3 Location
Component ID: MID-BUS

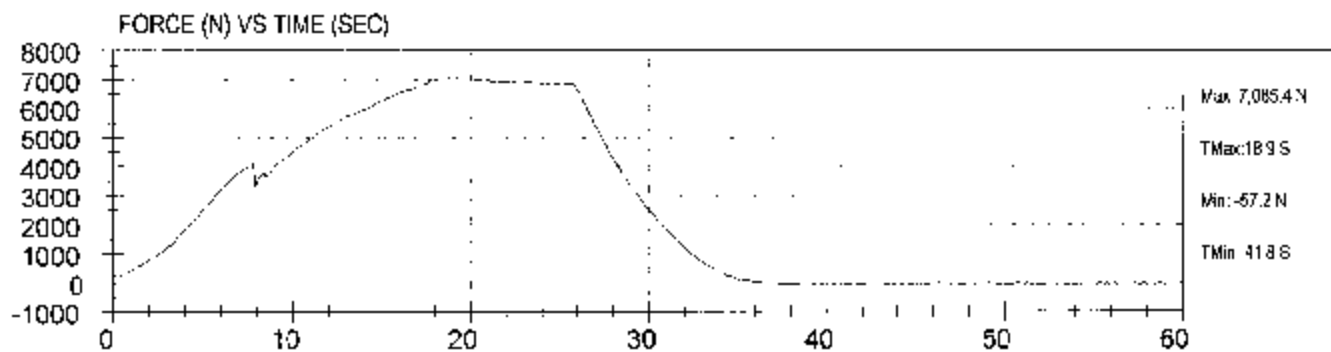
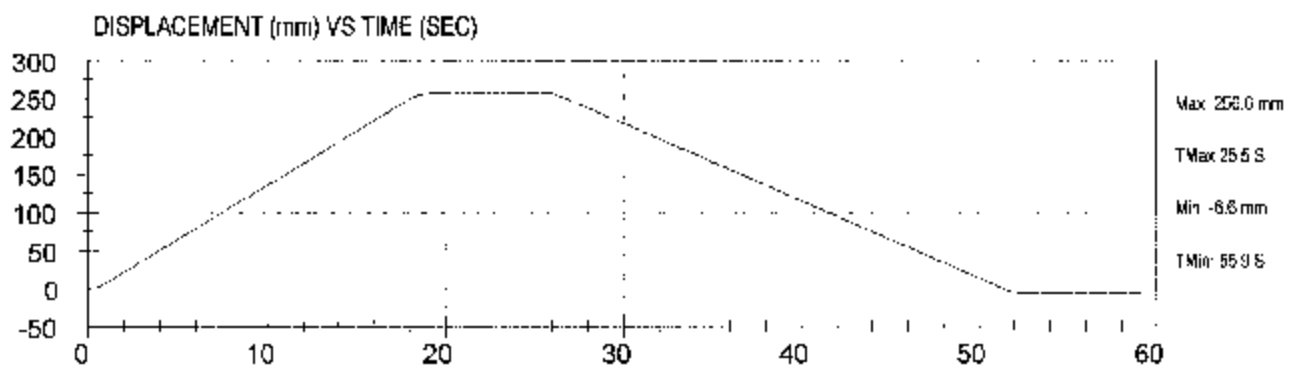
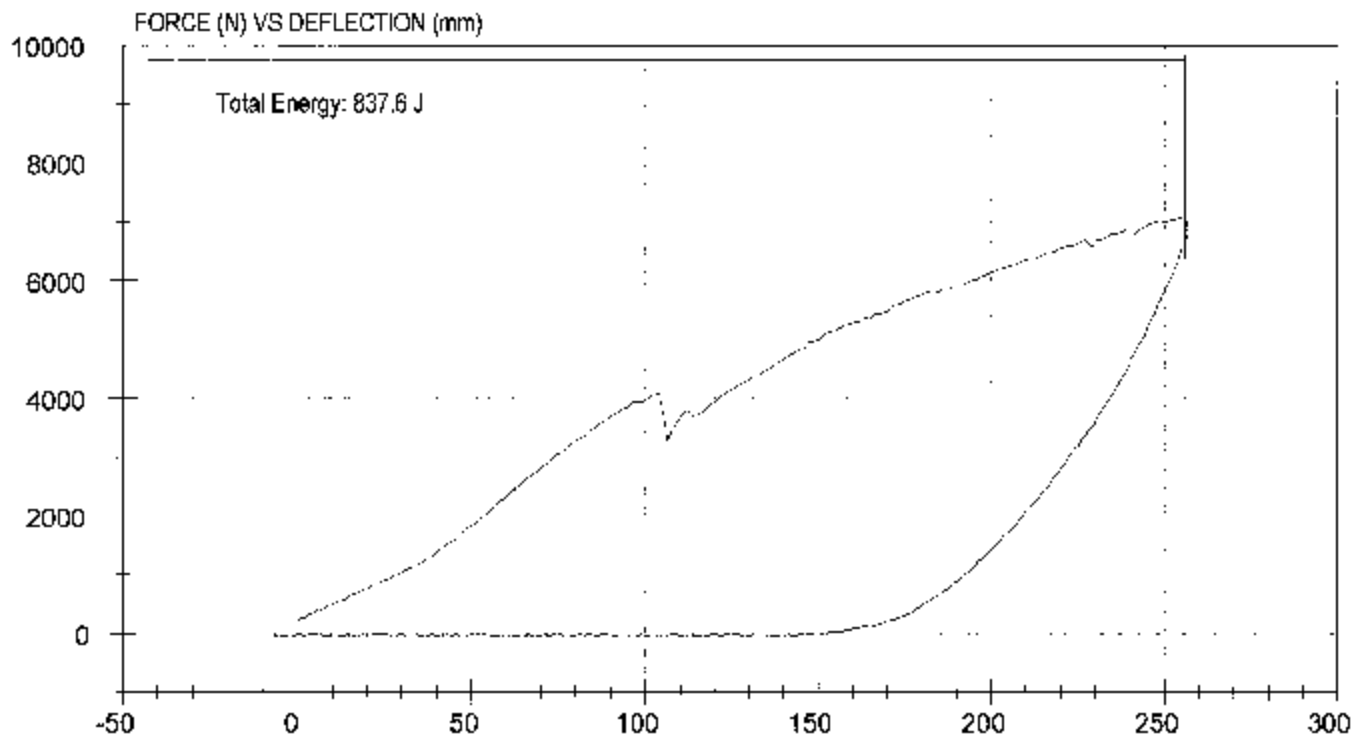
Test Date: 6/13/03
NHTSA #: C30903





Test Desc: SEAT REARWARD S3
Component ID: MID-BUS

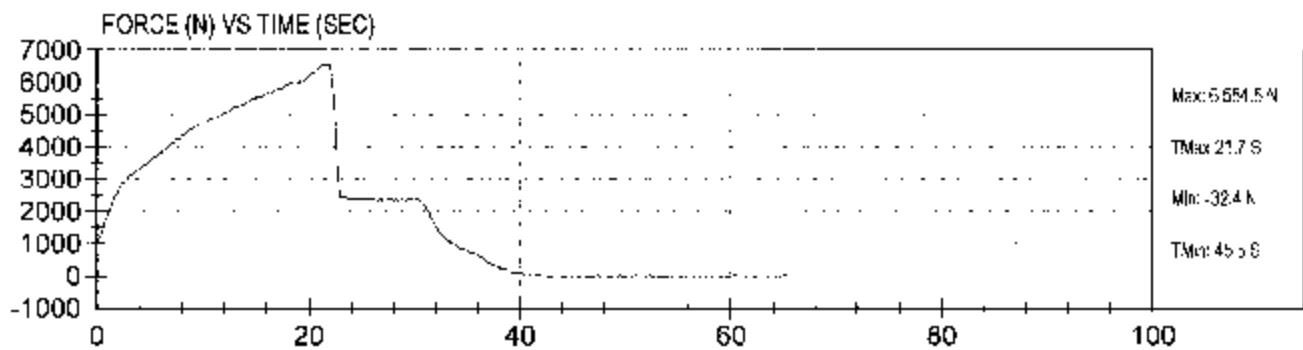
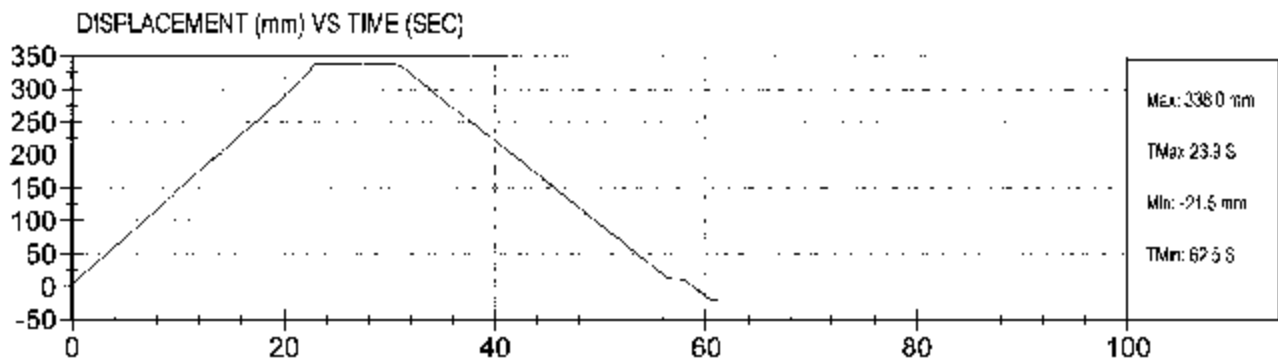
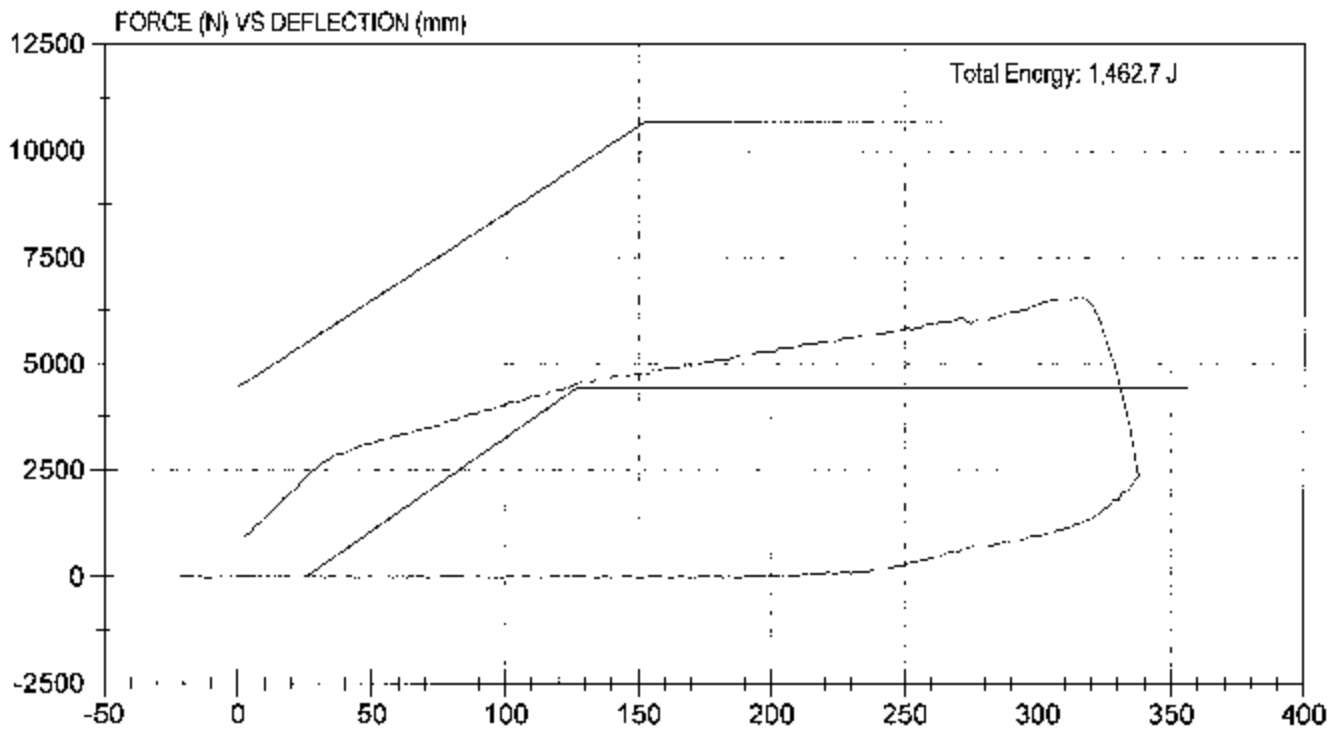
Test Date: 6/12/03
NHTSA #: C30903





Test Desc: B9 Deflection Forward Upper
Component ID: Mid-Bus

Test Date: 6/17/03
NHTSA #: C30903

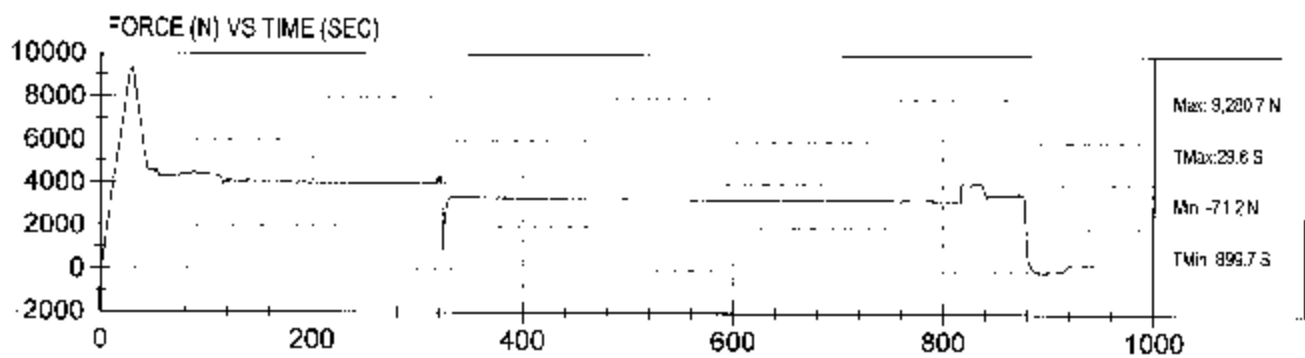
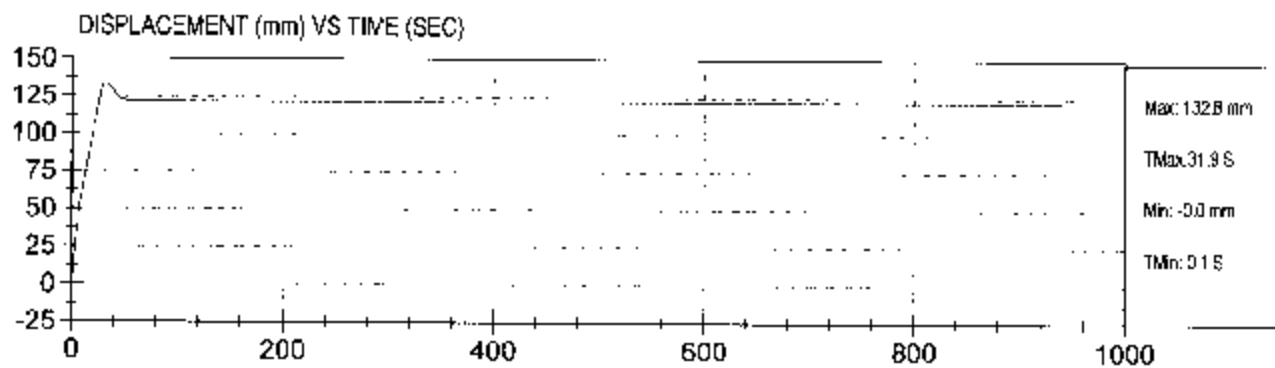
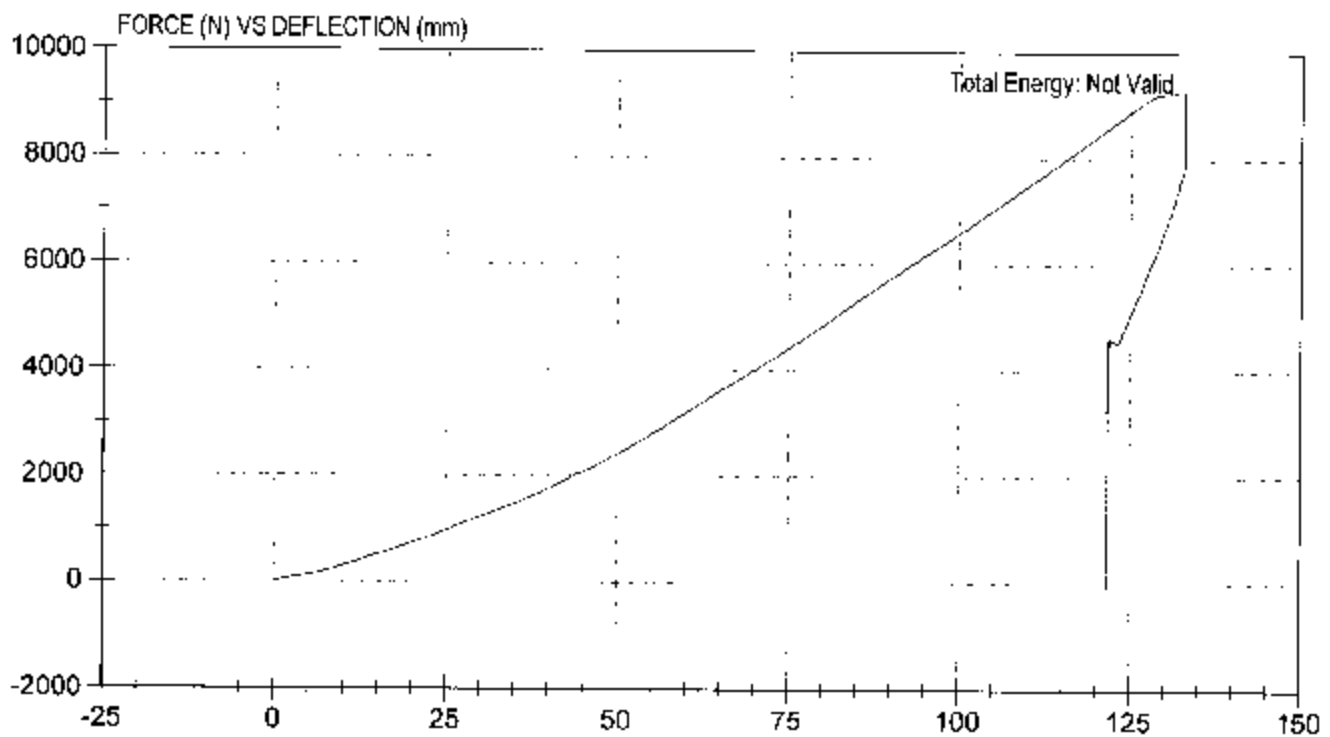




mga

Test Desc: Seat Deflection Forward B9
Component ID: Mid Bus

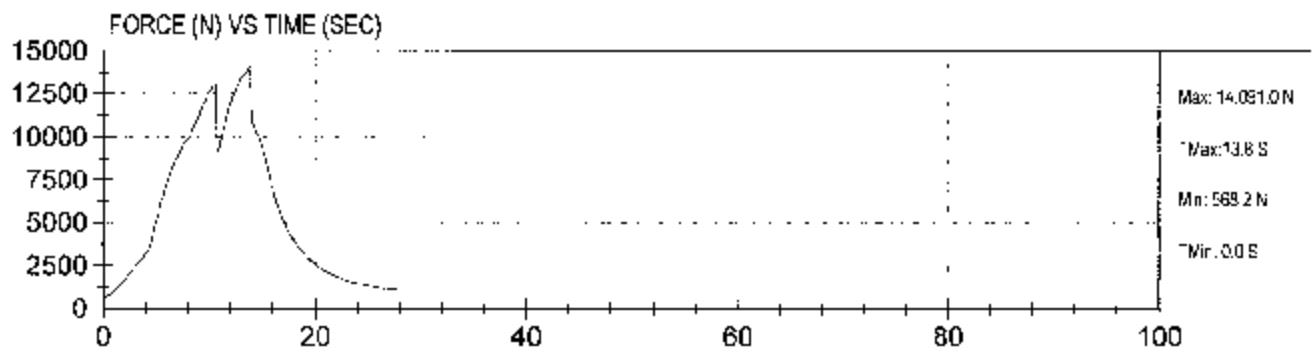
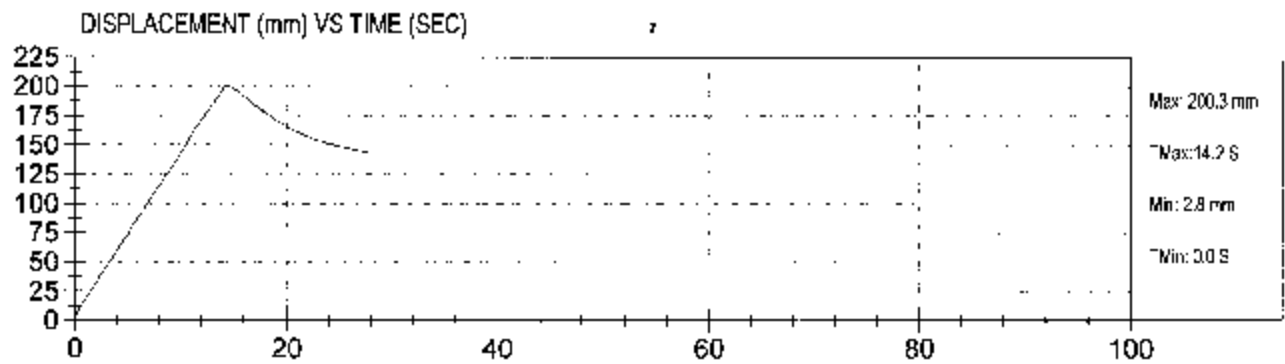
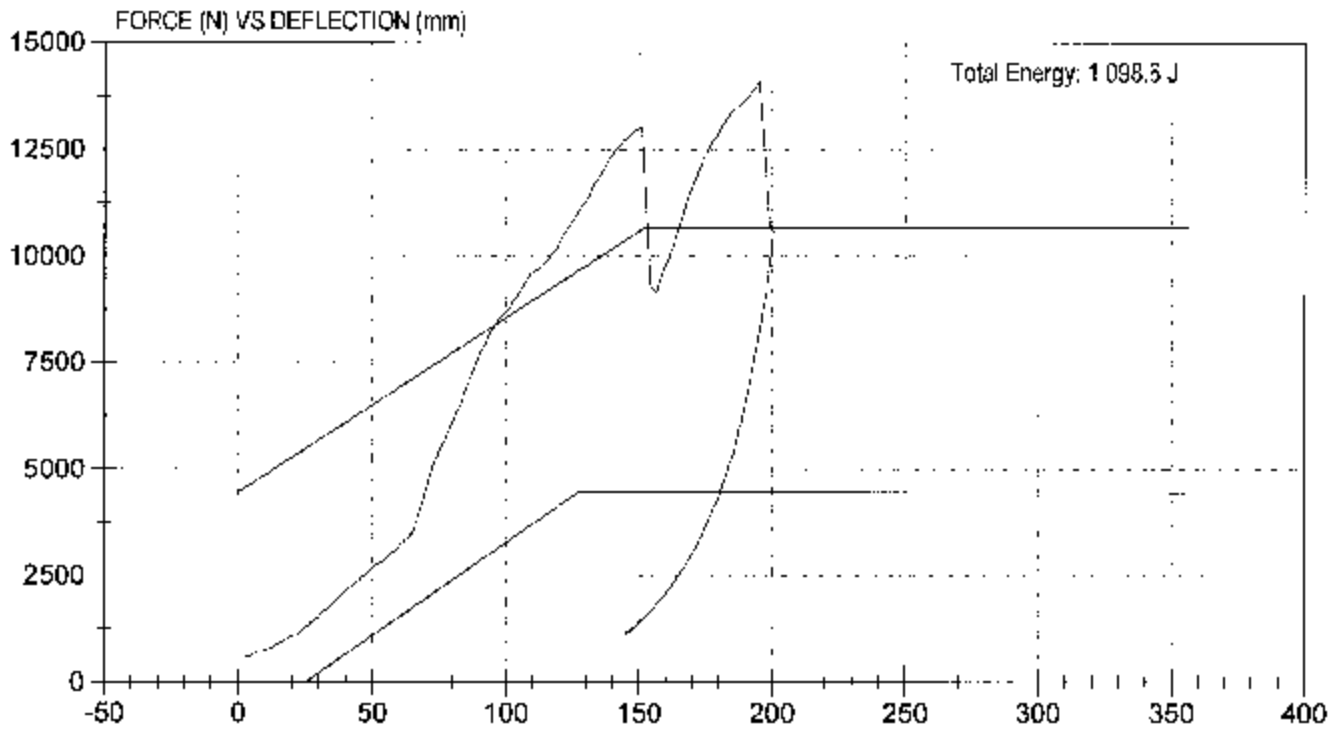
Test Date: 6/20/03
NHTSA #: C30903





Test Desc: B1 Deflection Forward Upper
Component ID: Mid-Bus

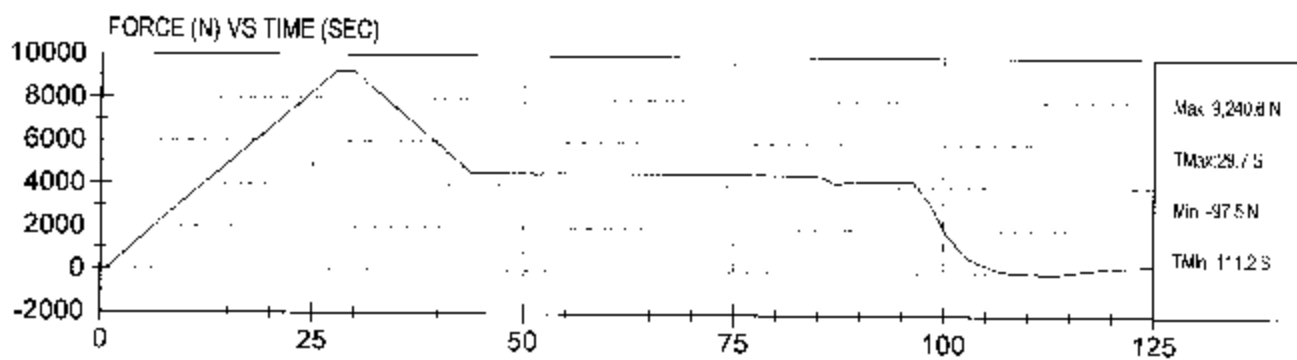
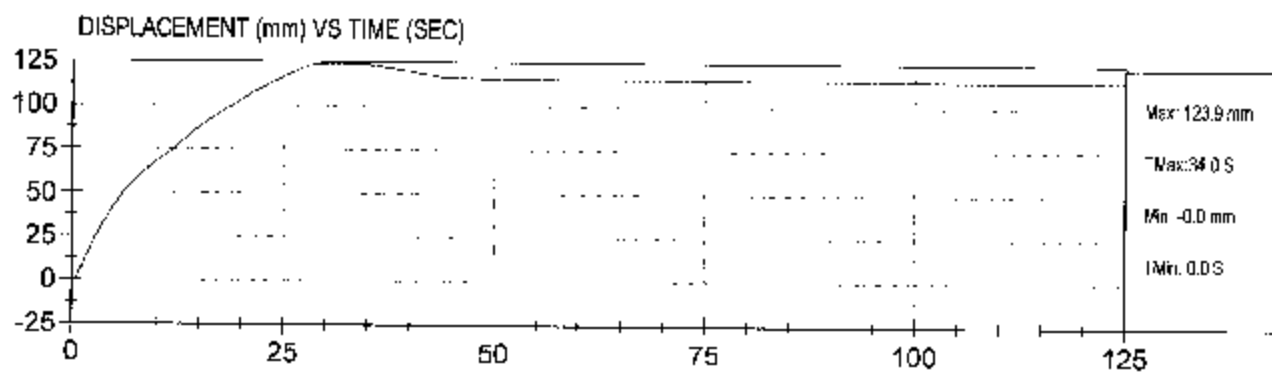
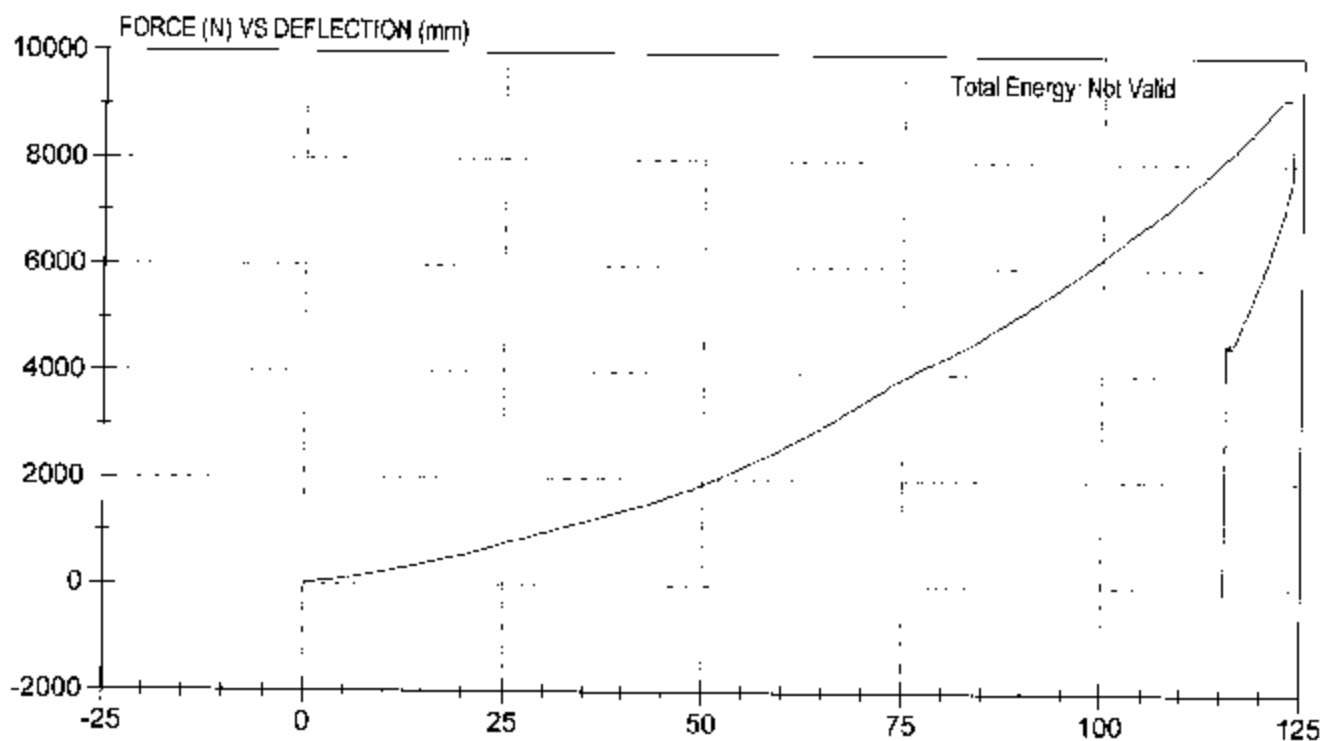
Test Date: 6/9/03
NHTSA #: C30903





Test Desc: B1 Barrier Lower
Component ID: Mid Bus

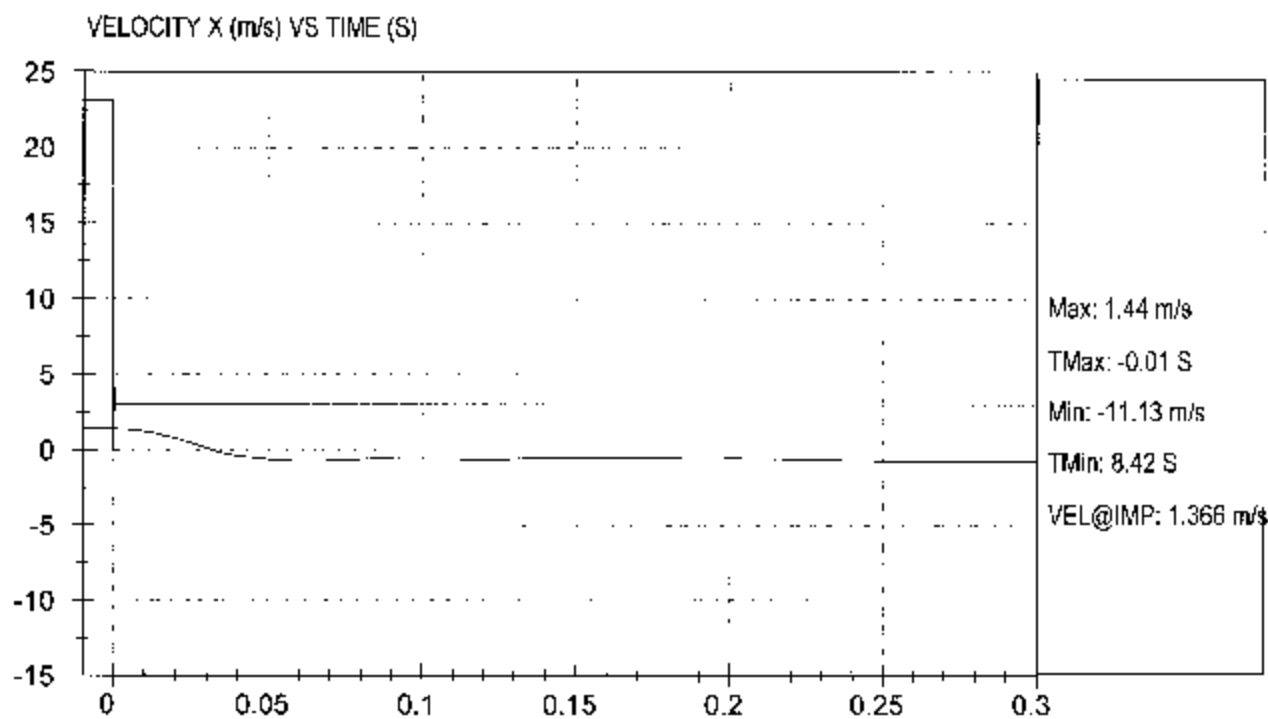
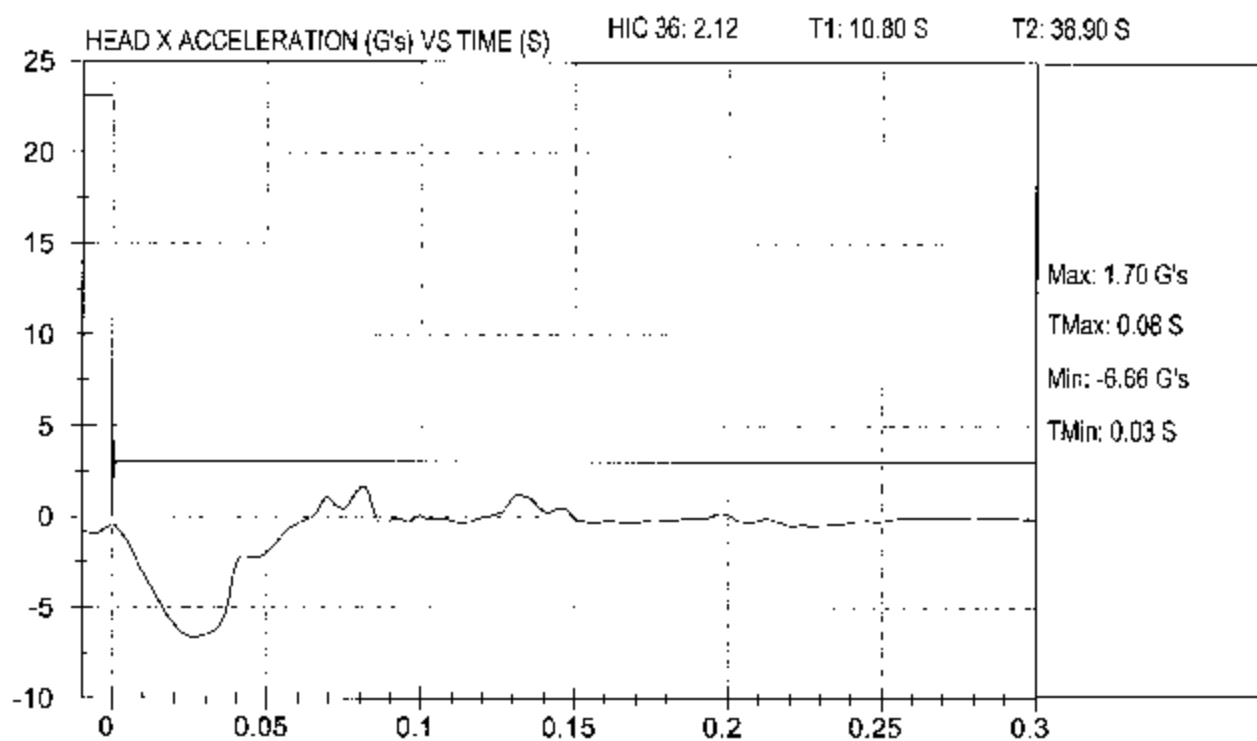
Test Date: 6-9-03
NHTSA #: C30903





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

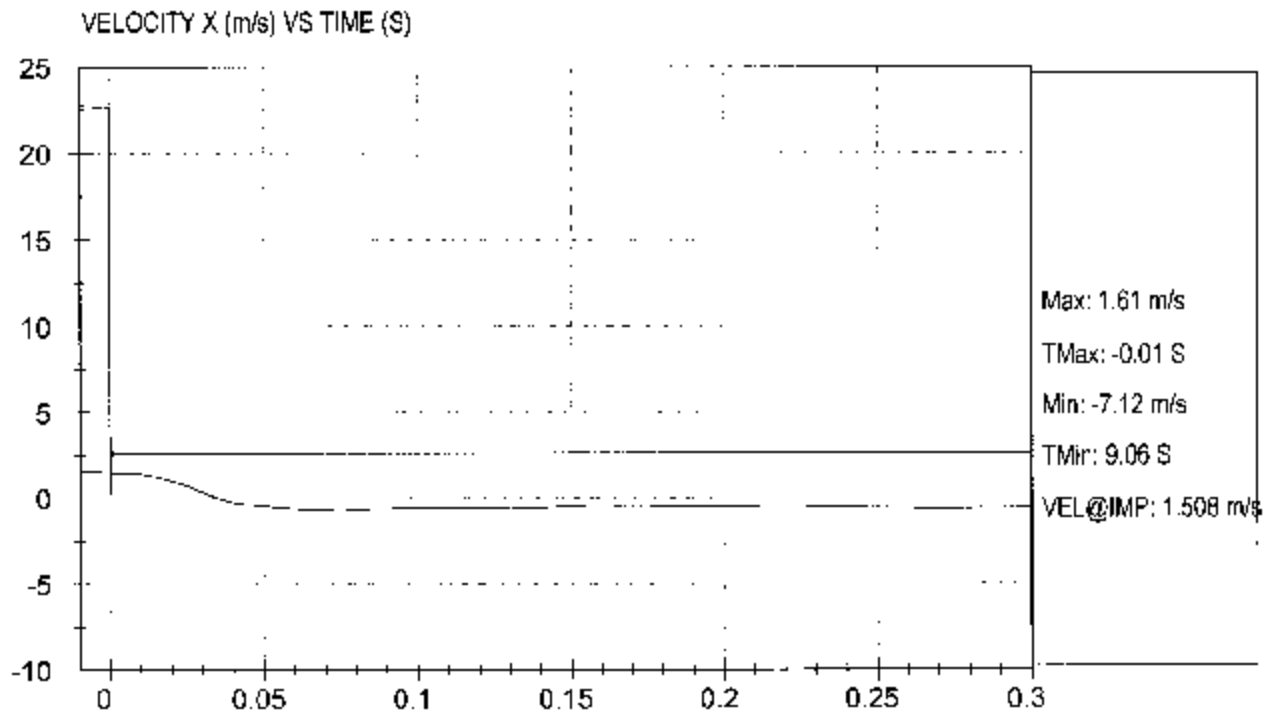
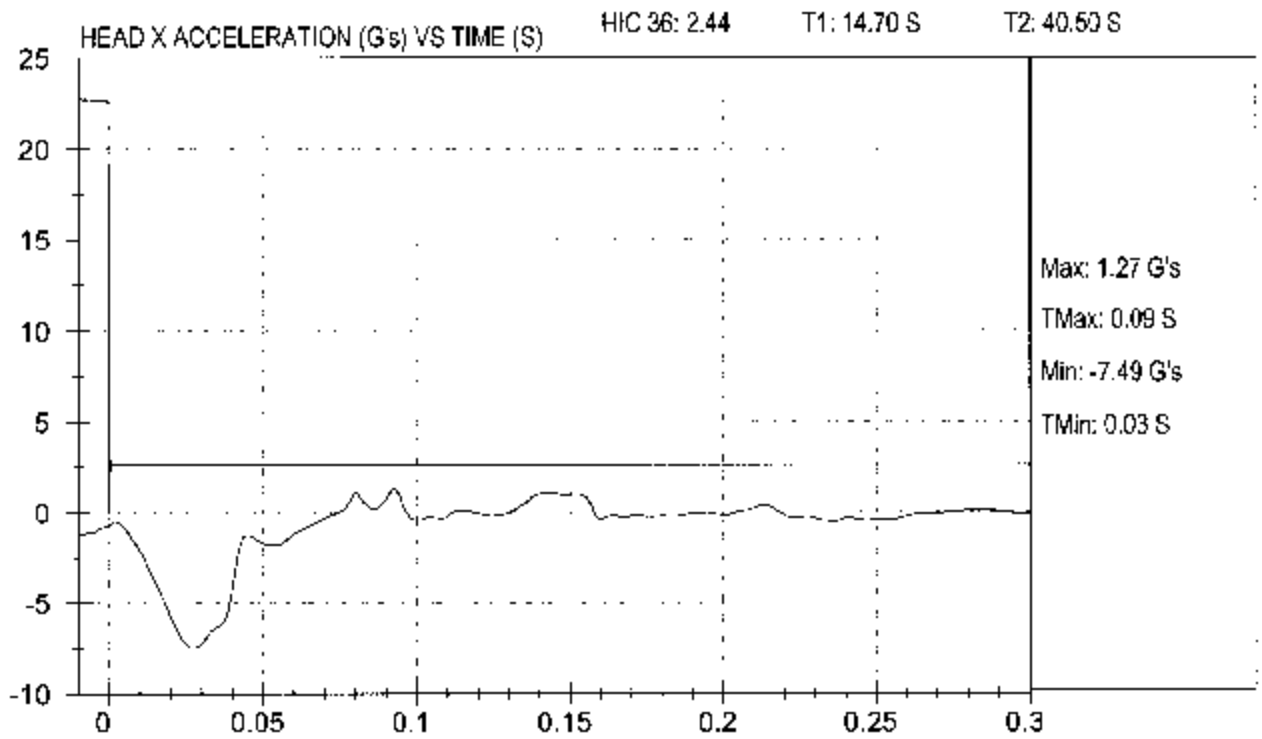
Test Date: 6-11-03
Location: H1





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

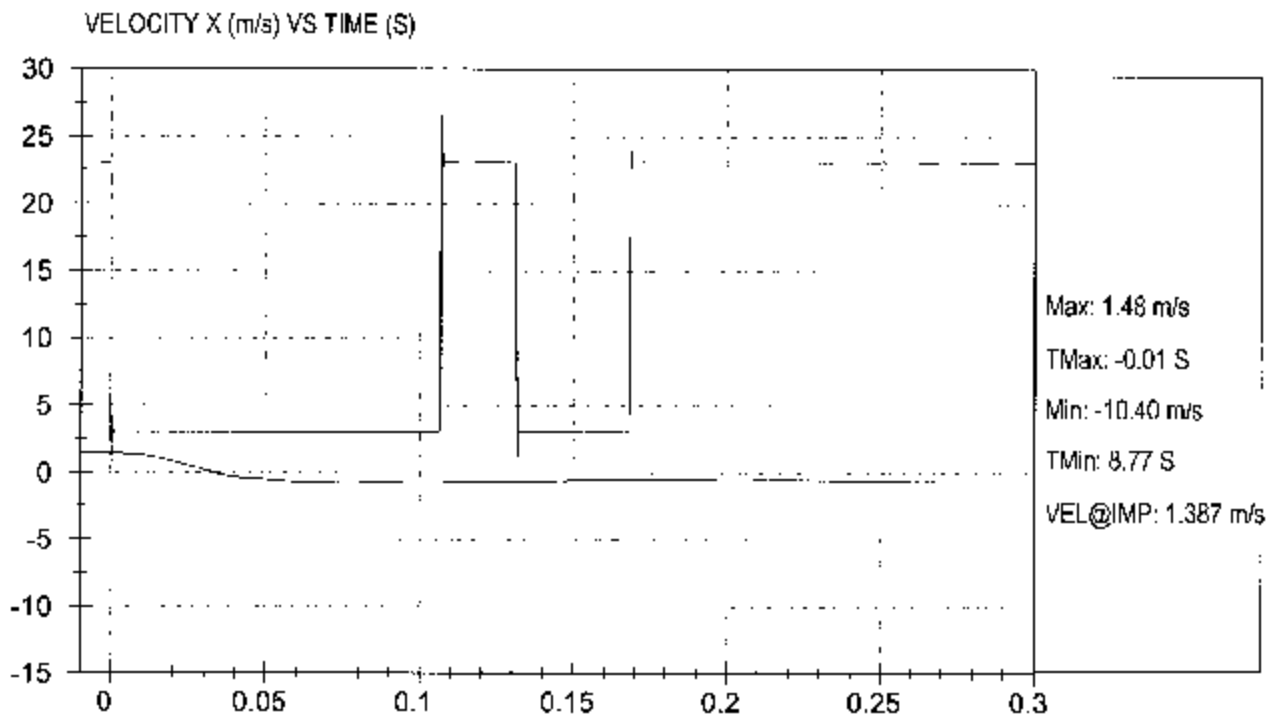
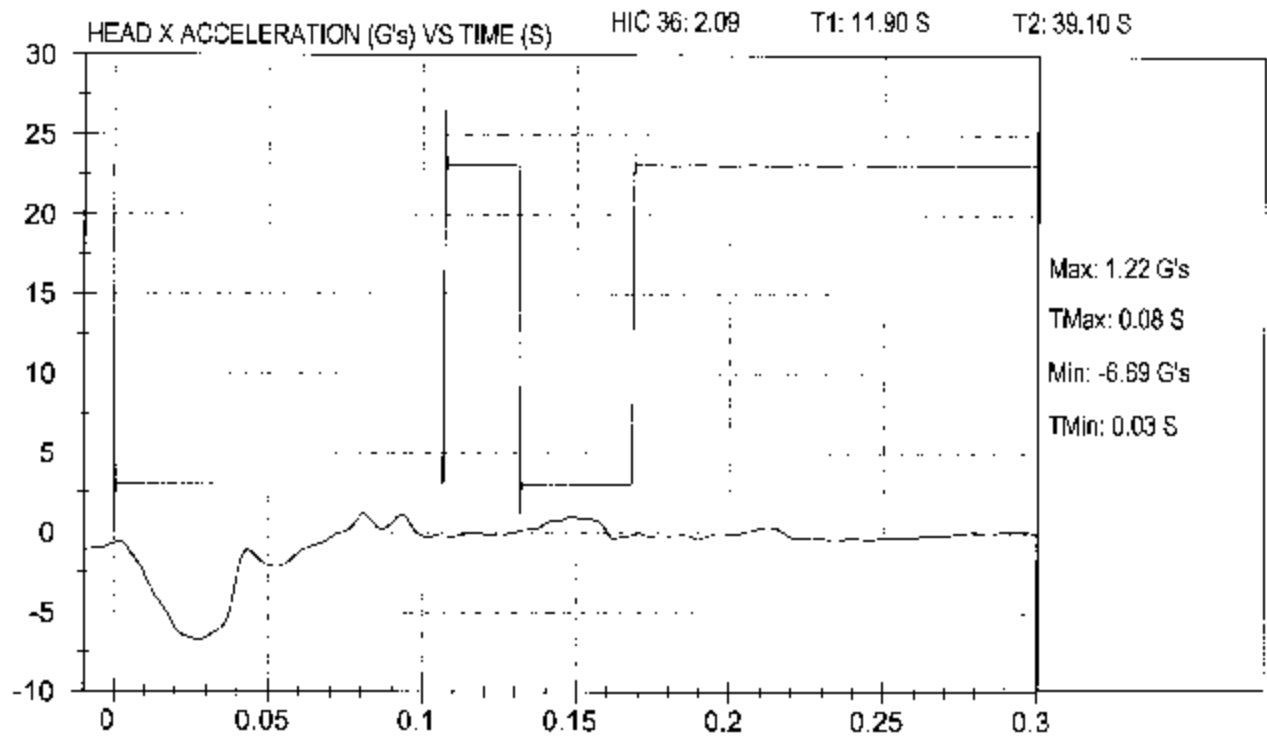
Test Date: 6-11-03
Location: H2





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

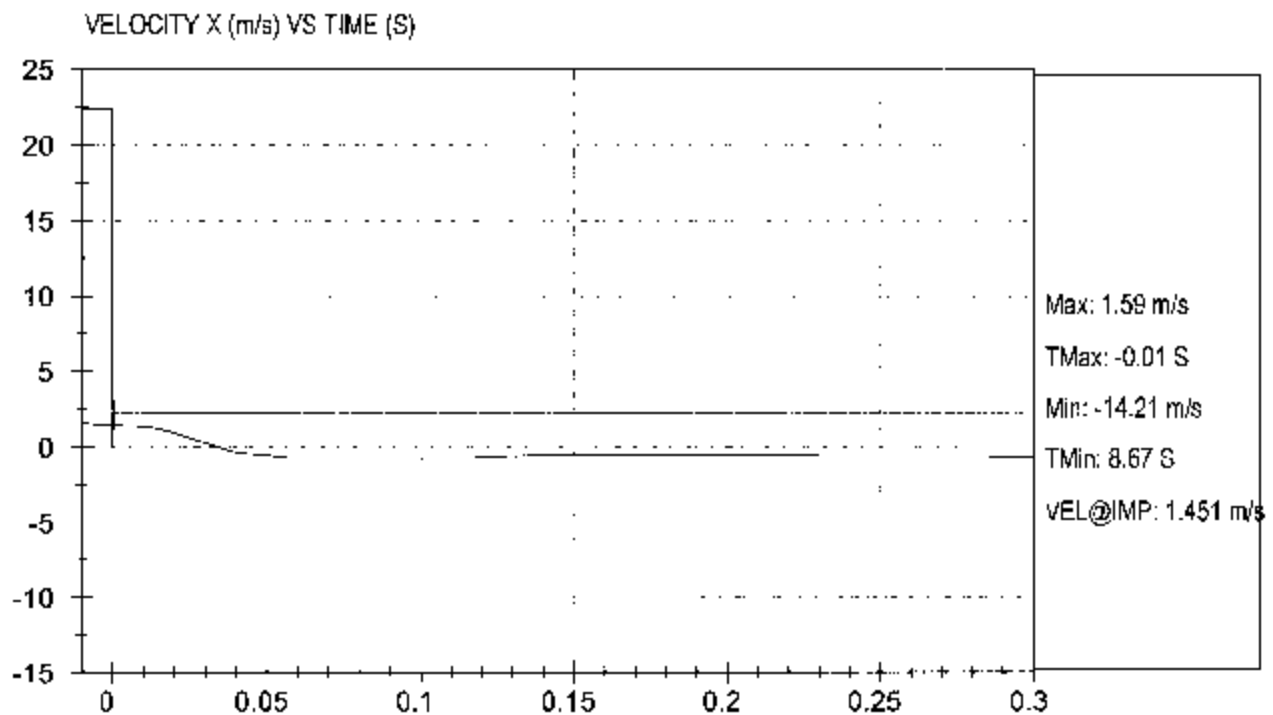
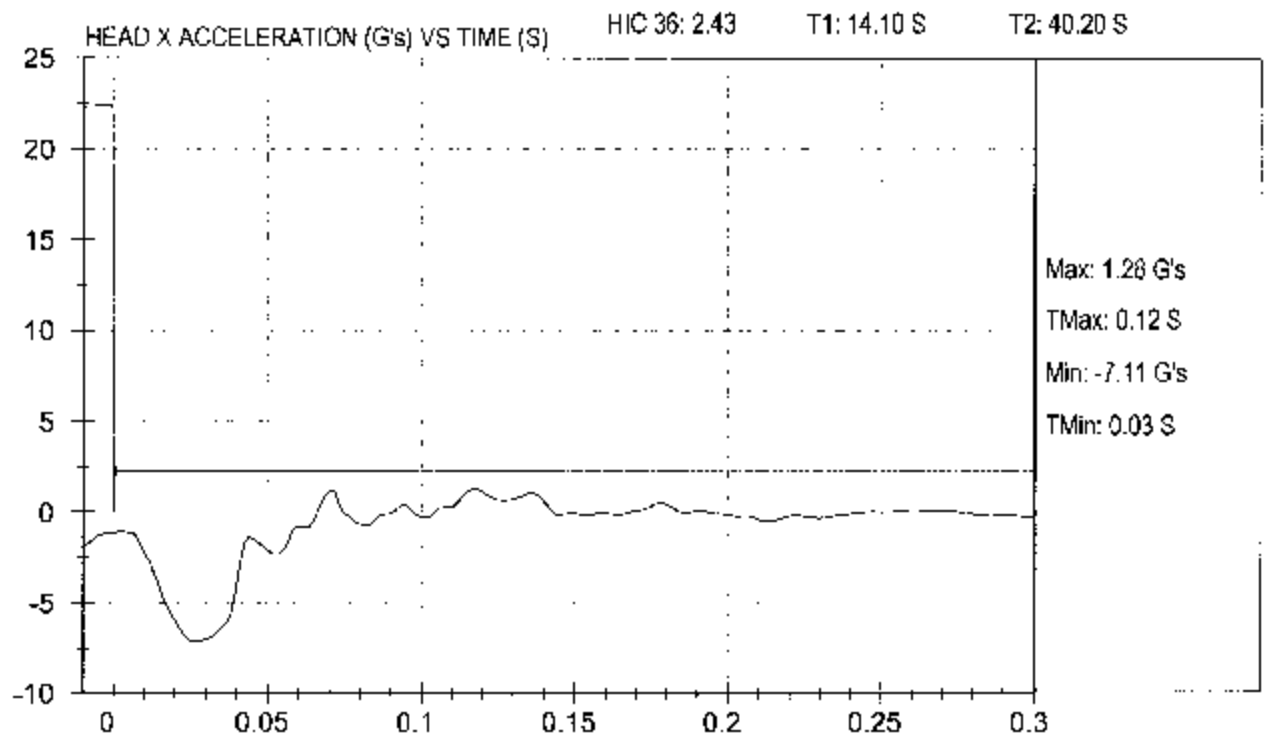
Test Date: 6-11-03
Location: H3





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mic Bus
NHTSA #: C30903

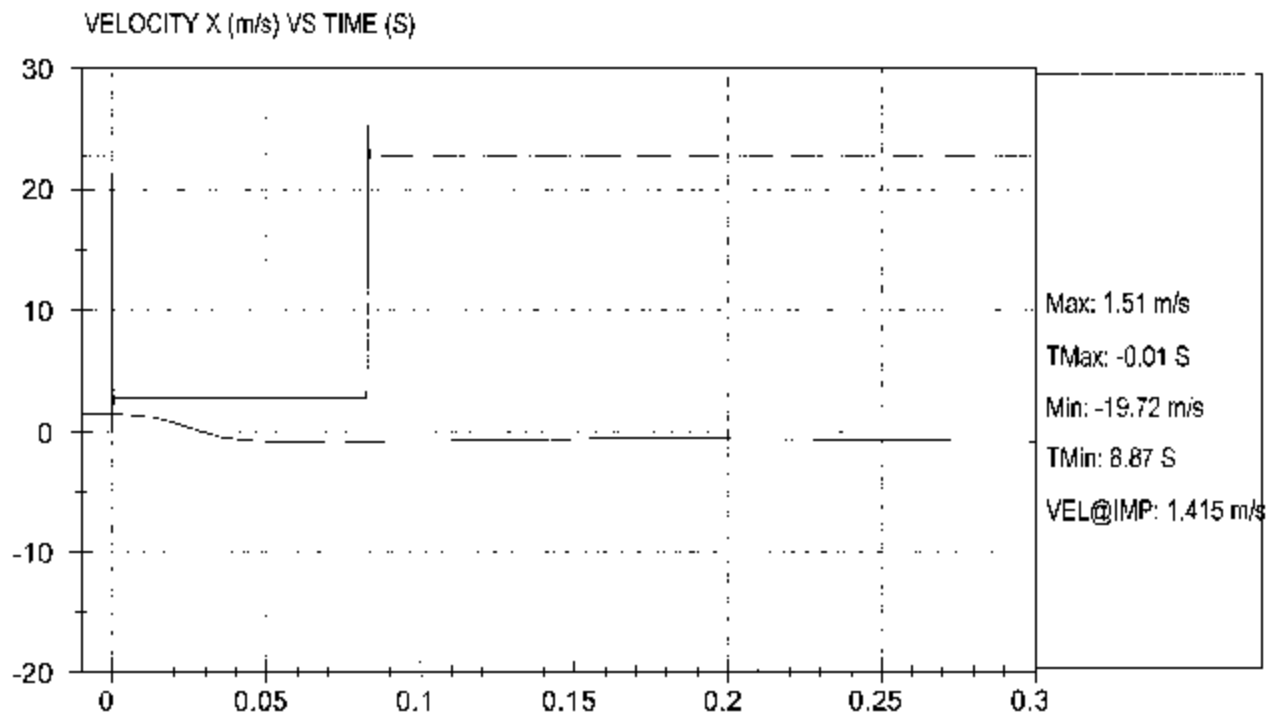
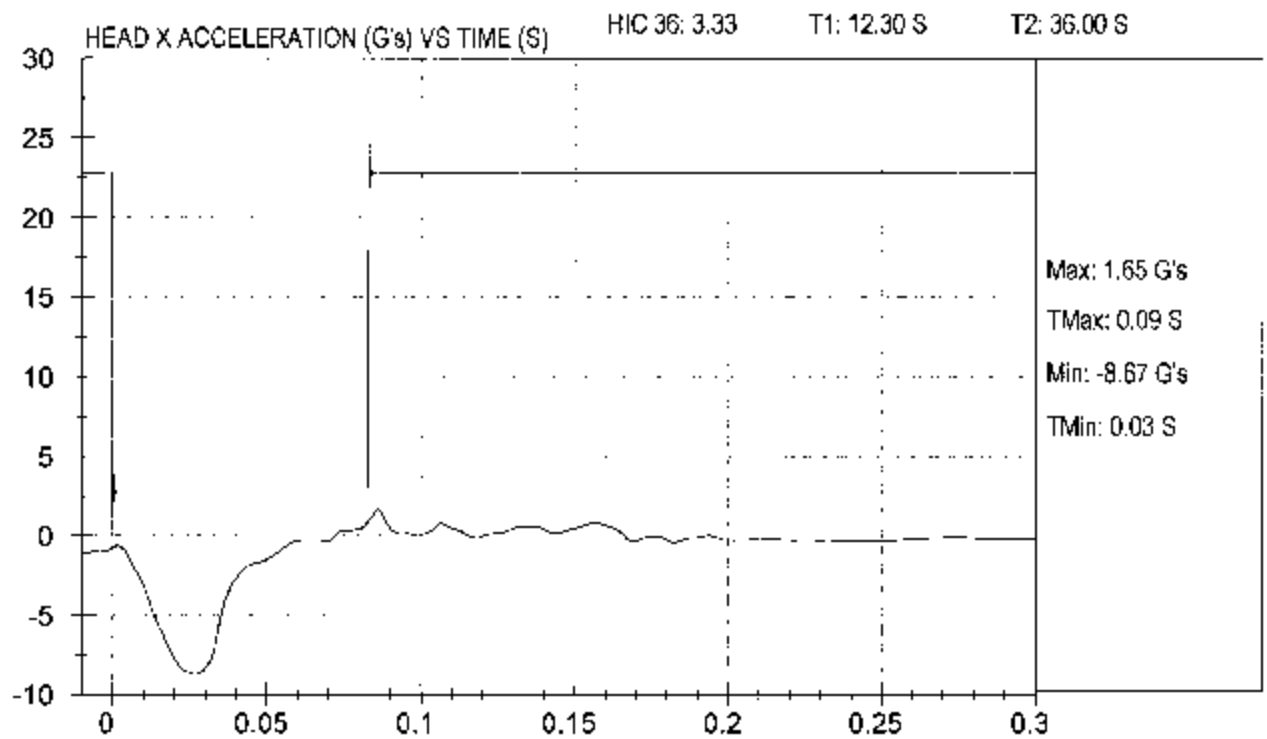
Test Date: 6-11-03
Location: H4





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mic Bus
NHTSA #: C30903

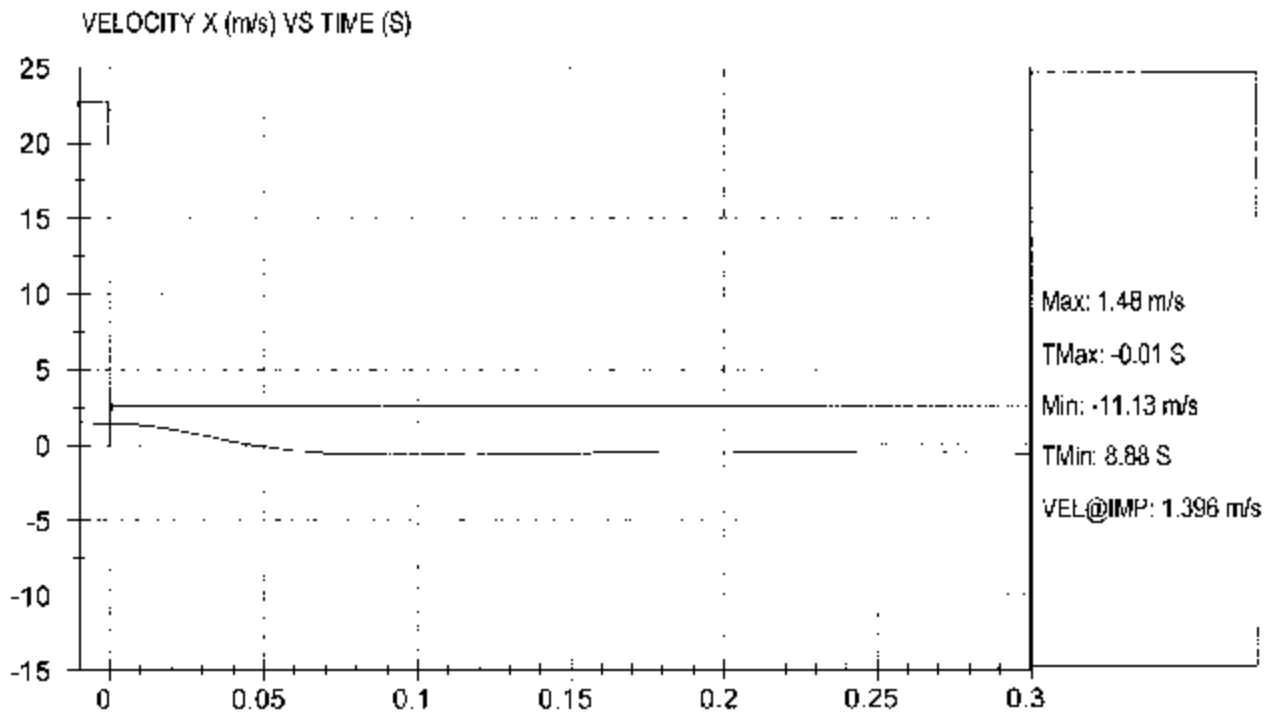
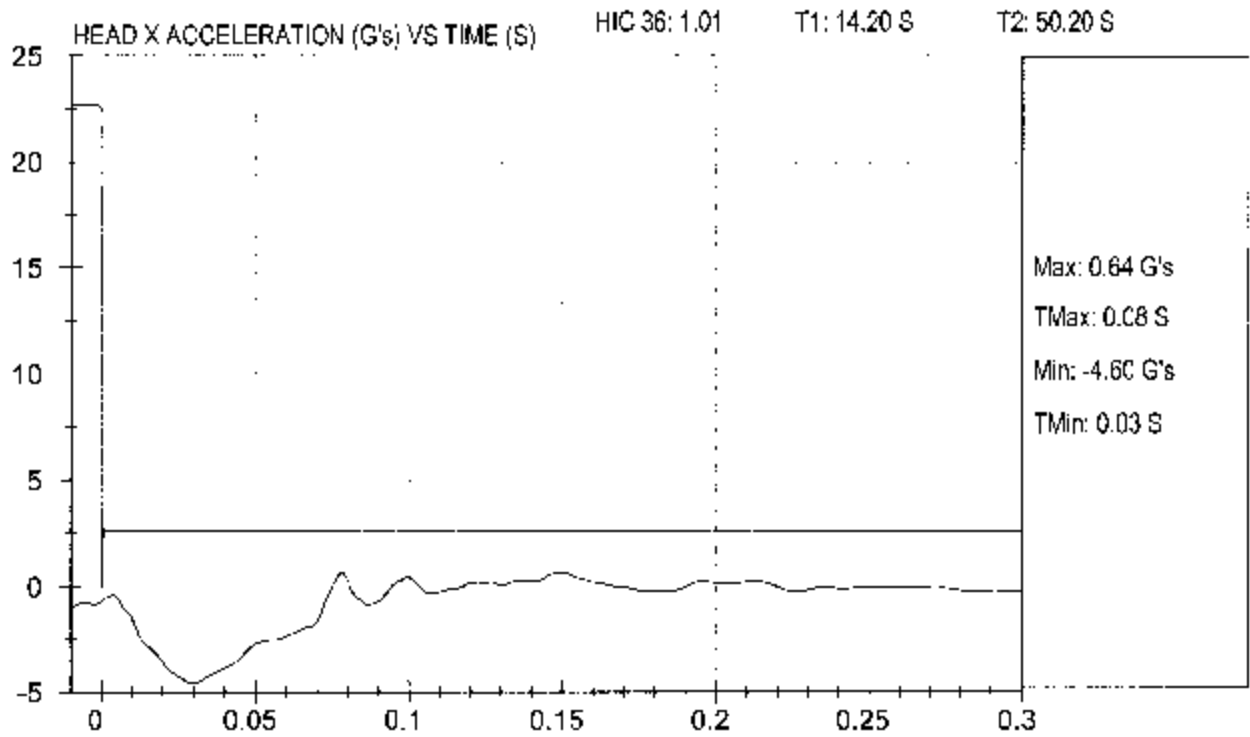
Test Date: 6-11-03
Location: H5





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mid BLs
NHTSA #: C30903

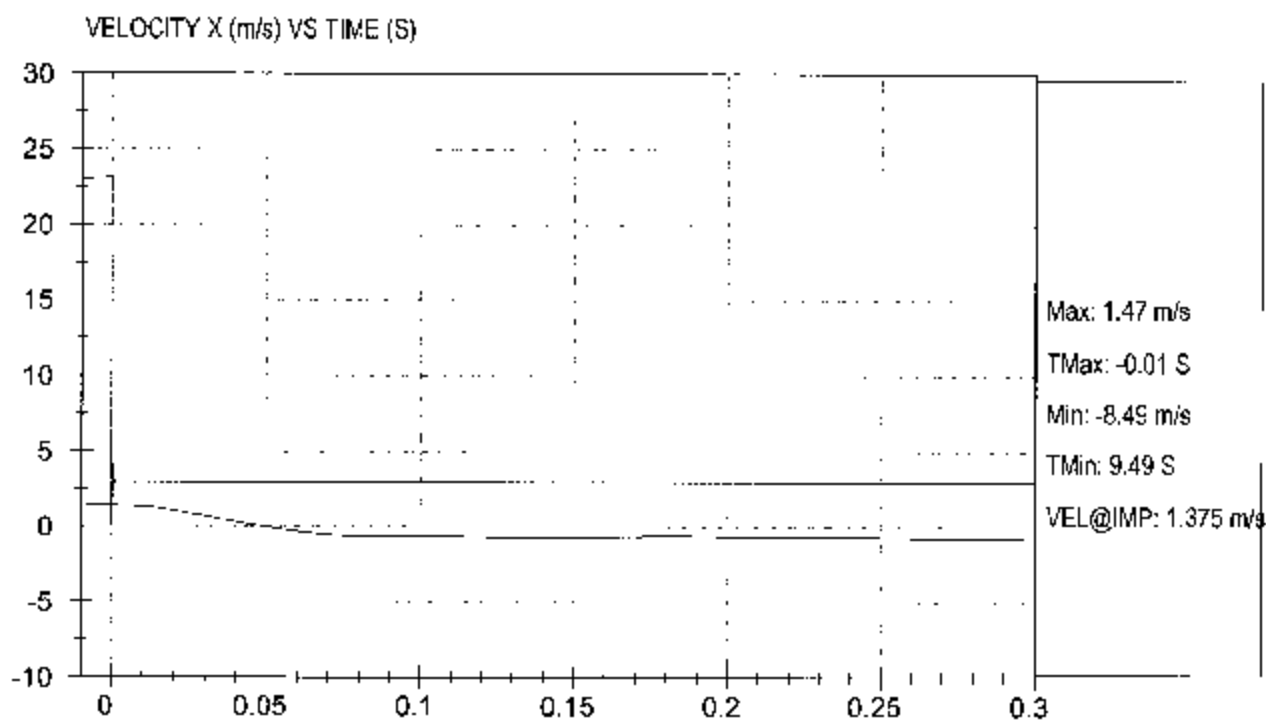
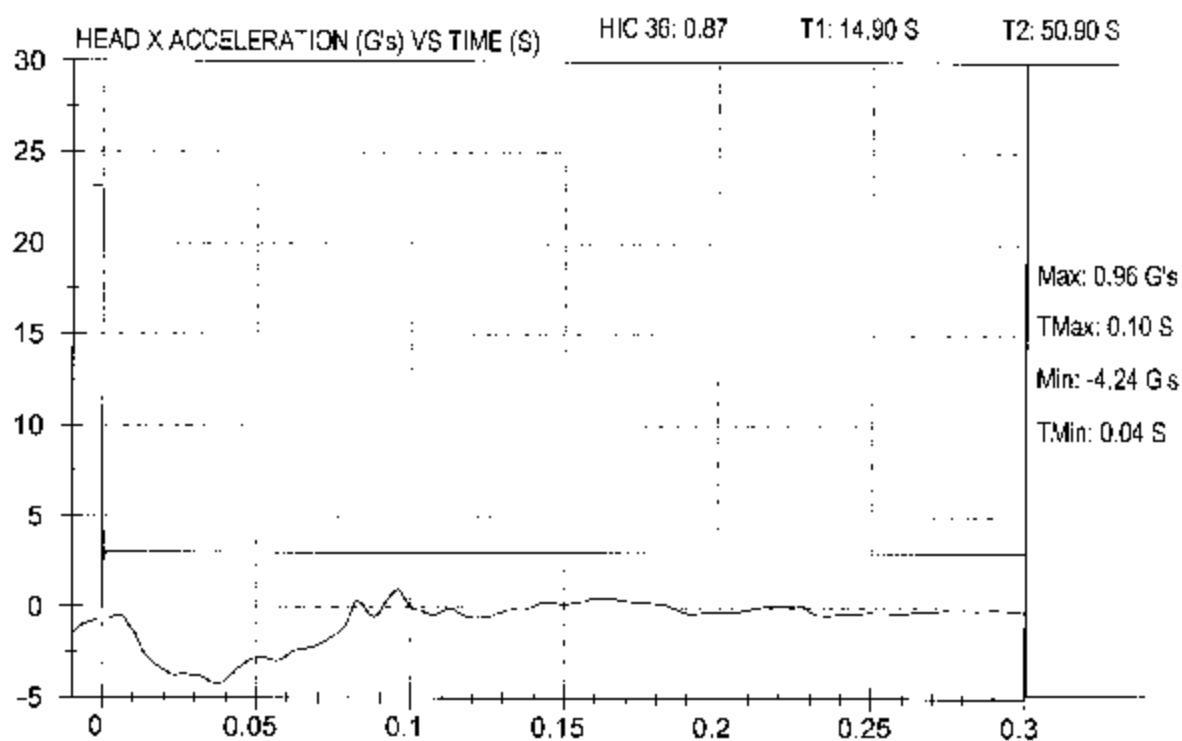
Test Date: 6-11-03
Location: H6





FMVSS 222 HEAD FORM IMPACTS (1.5 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

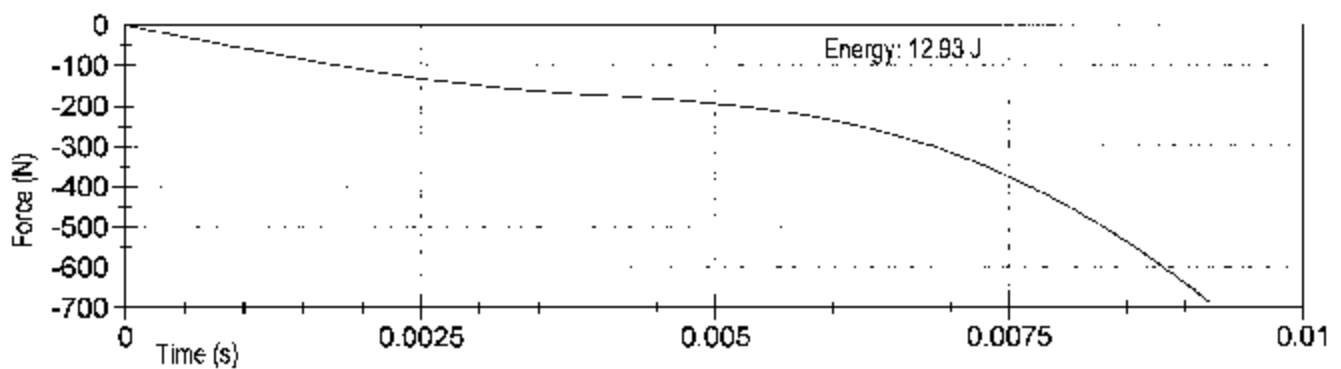
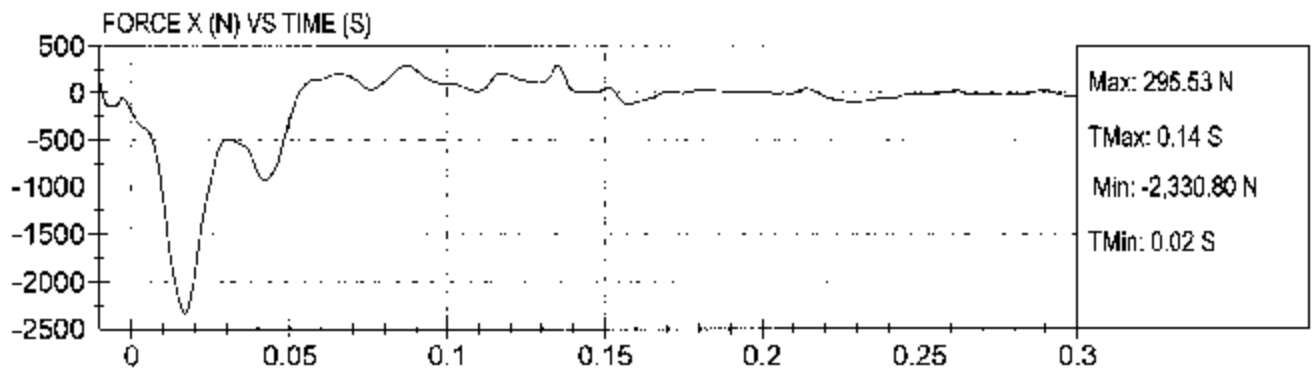
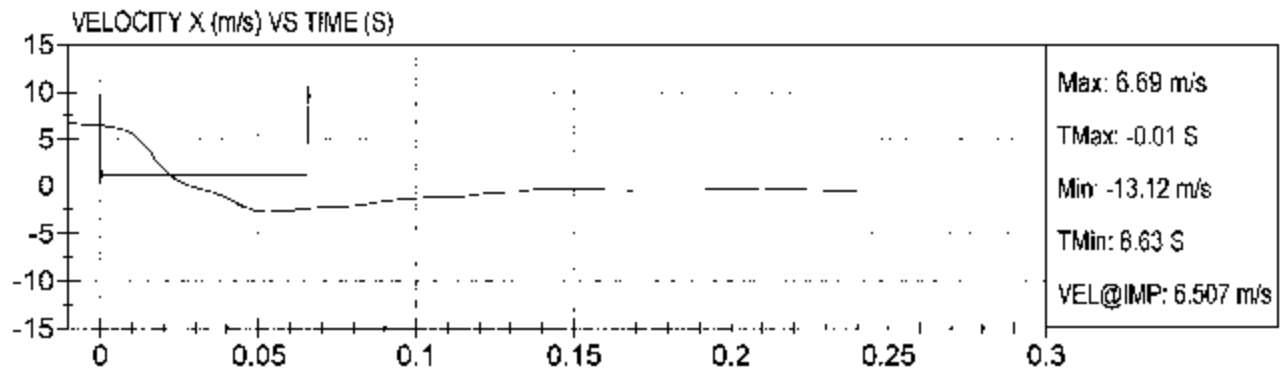
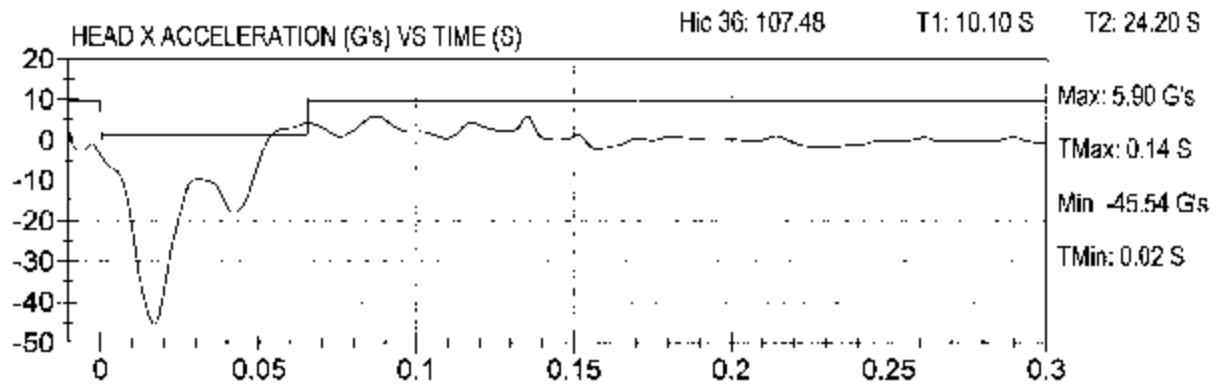
Test Date: 6-11-03
Location: H7





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

Test Date: 6/11/03
Location: H8





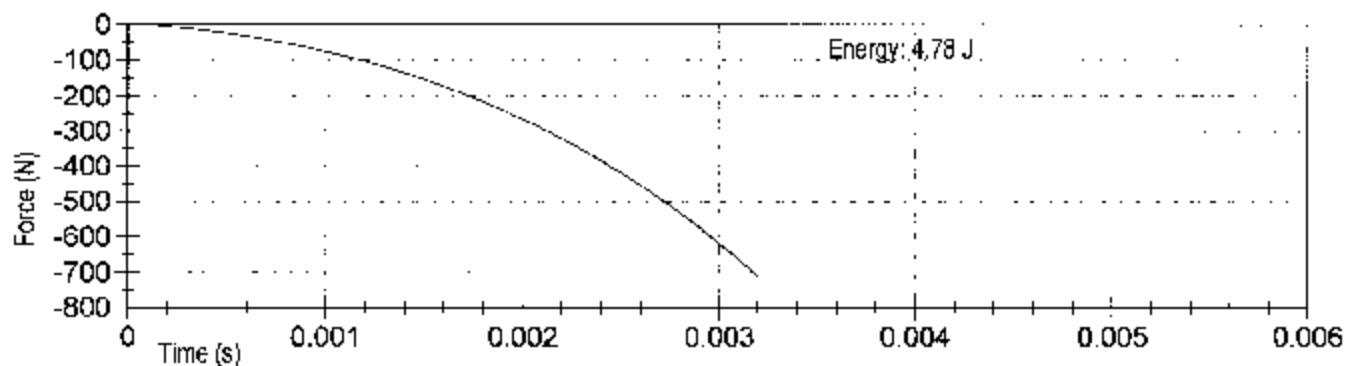
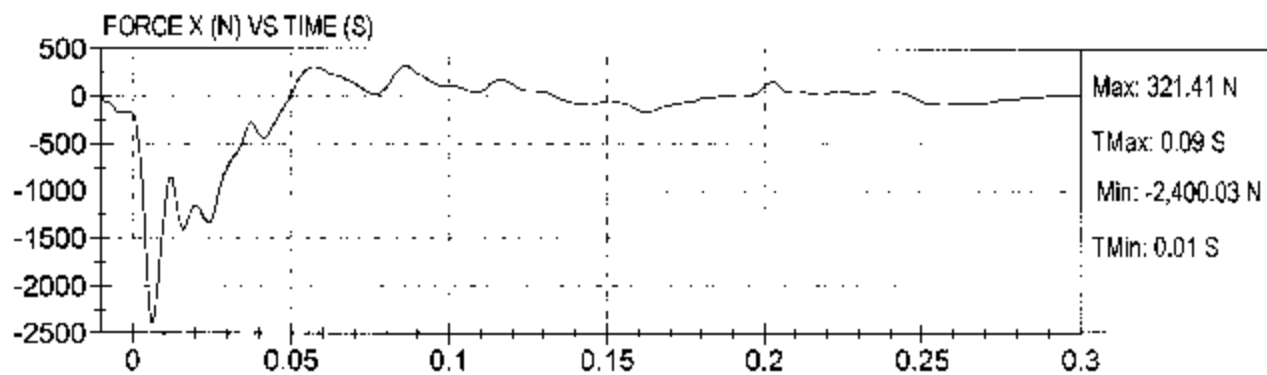
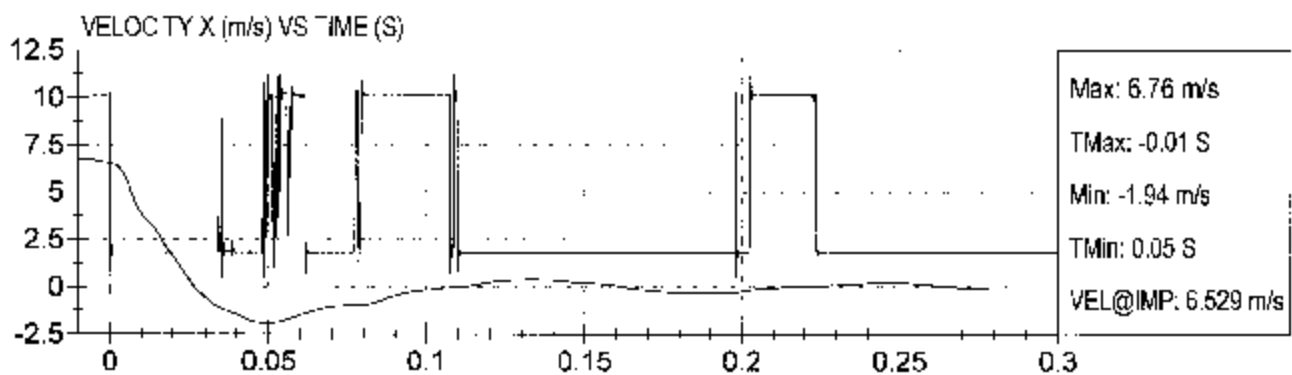
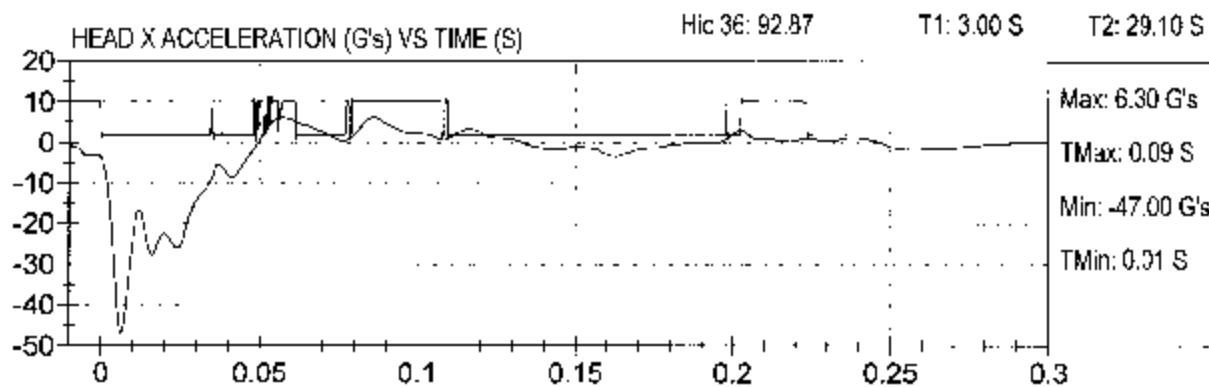
FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)

Vehicle: Mid Bus

NHTSA #: C30903

Test Date: 6/11/03

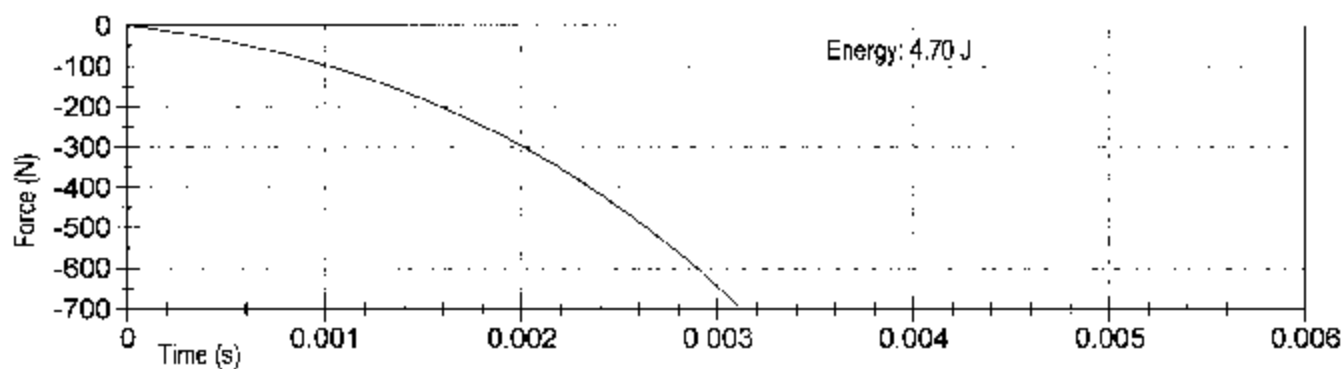
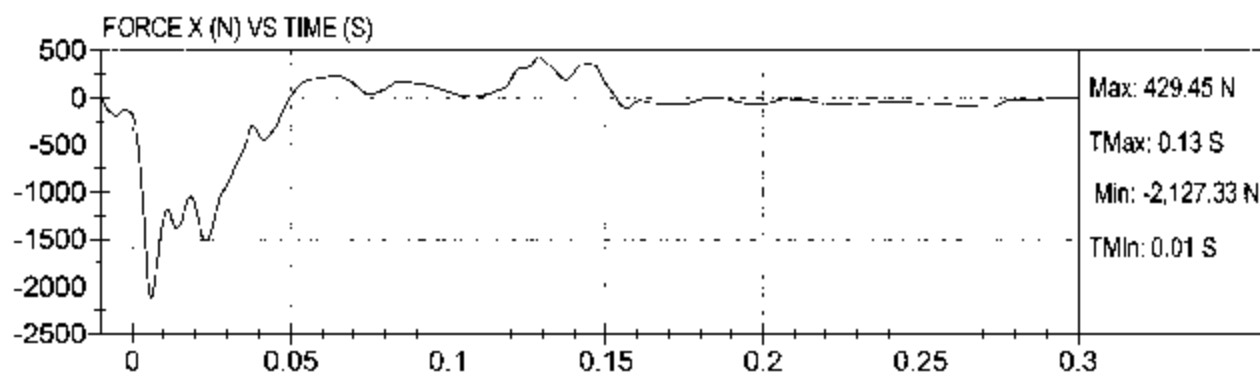
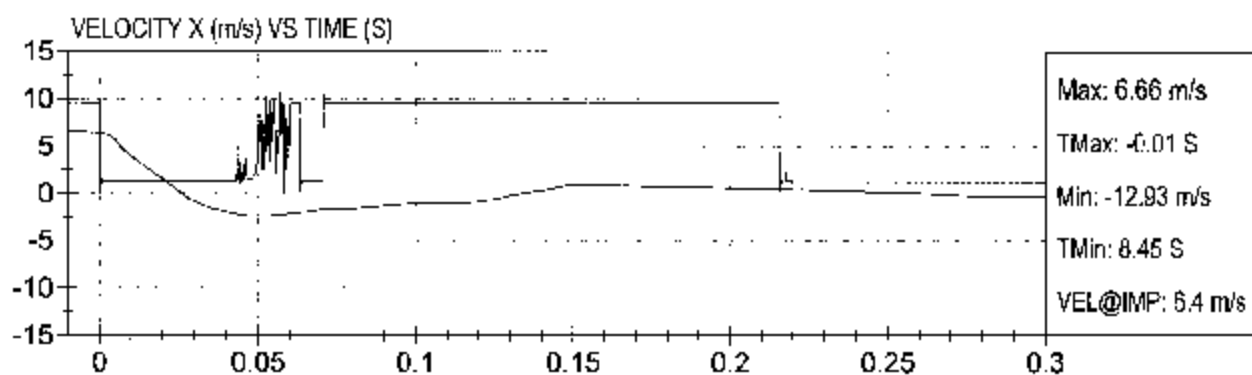
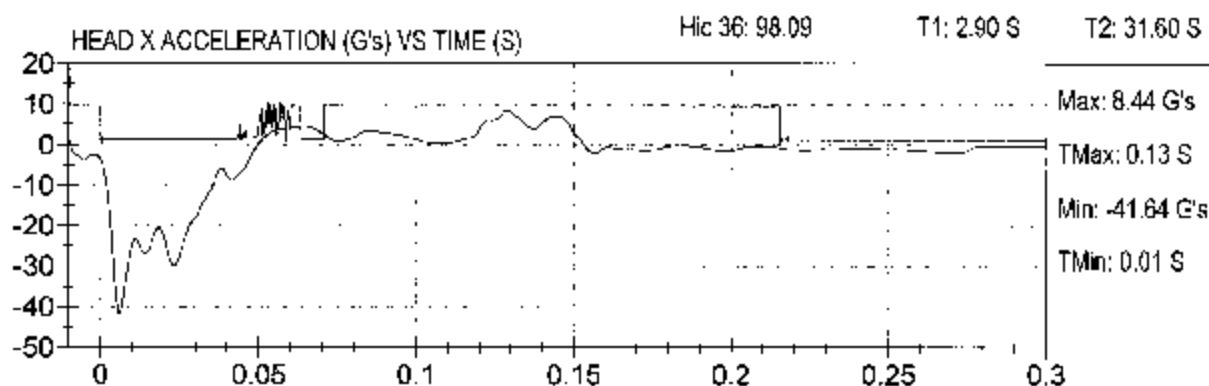
Location: I19





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

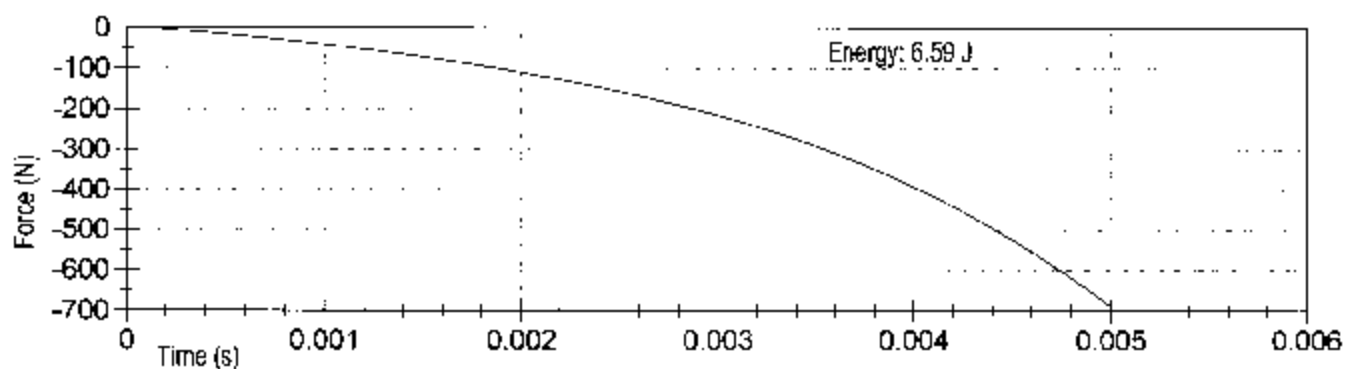
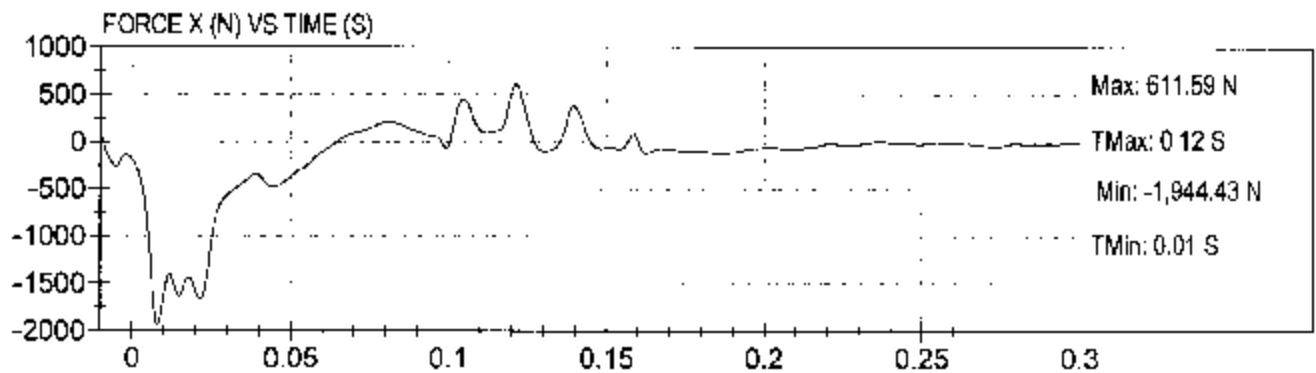
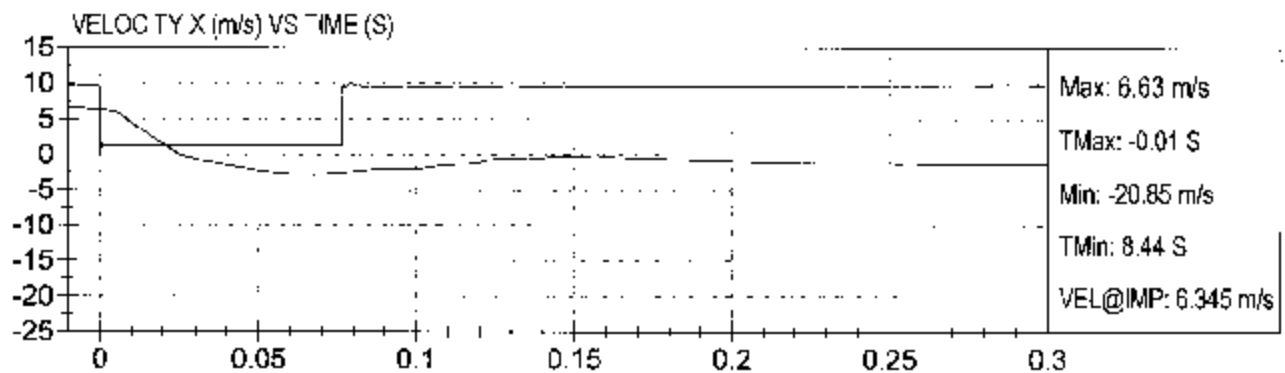
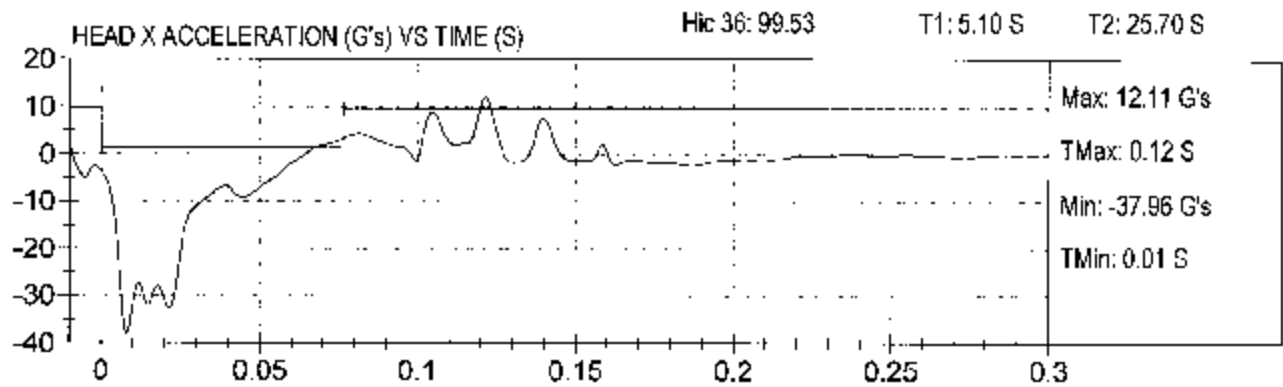
Test Date: 6/11/03
Location: H10





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

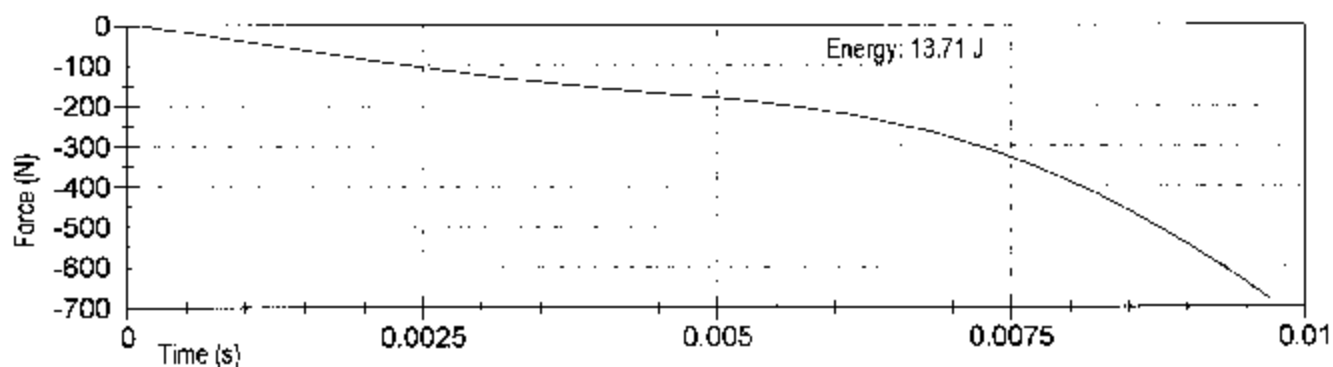
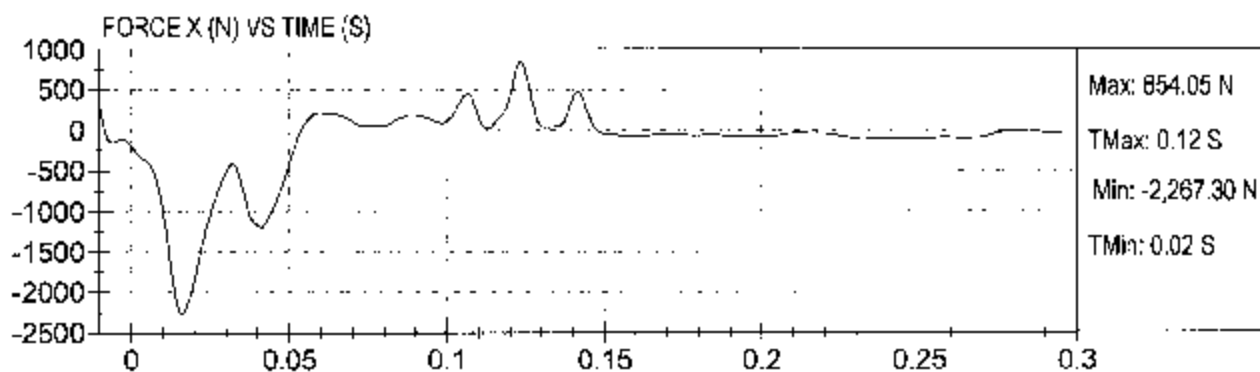
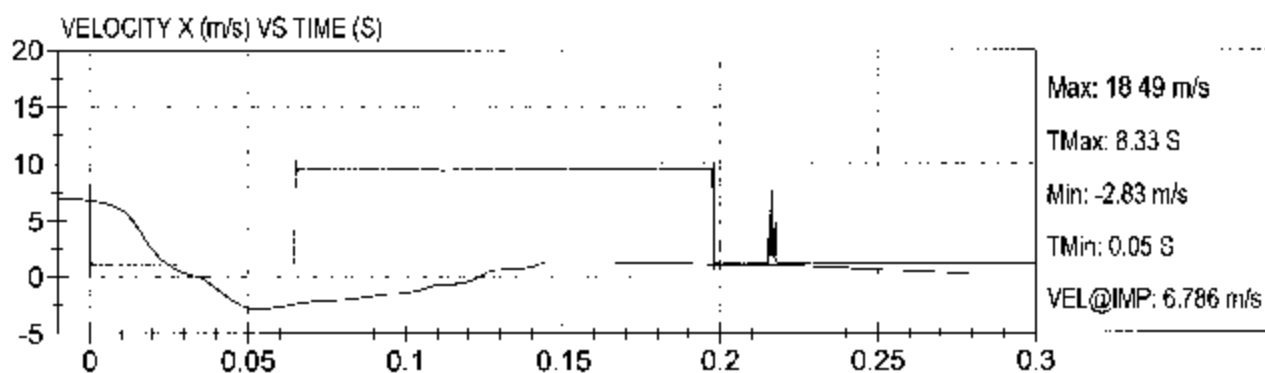
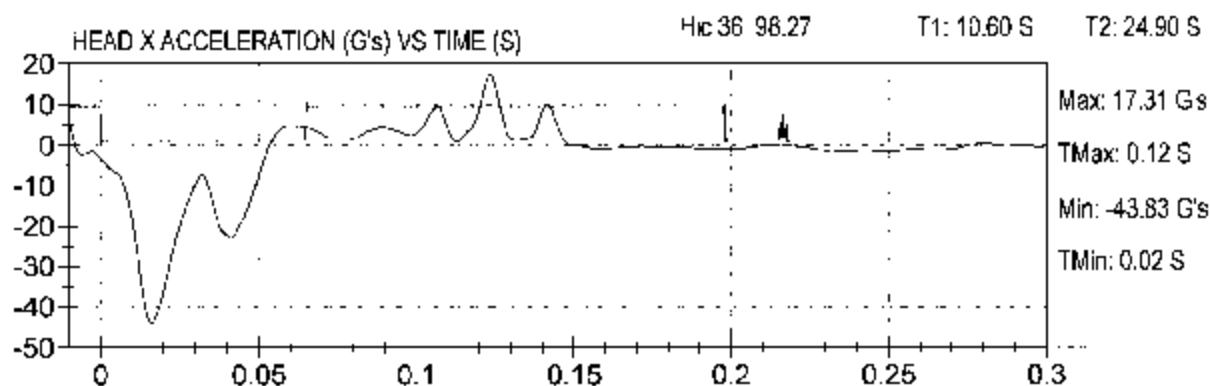
Test Date: 6/11/03
Location: H11





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

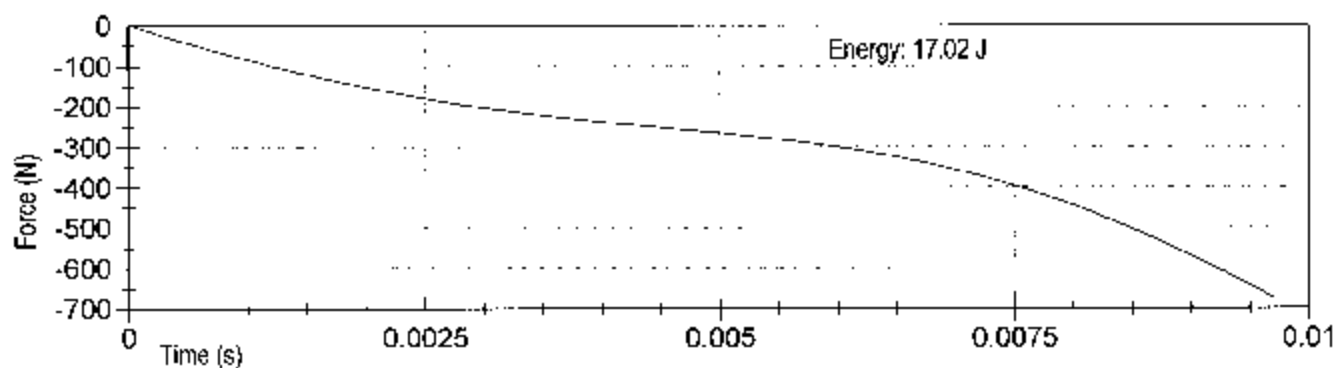
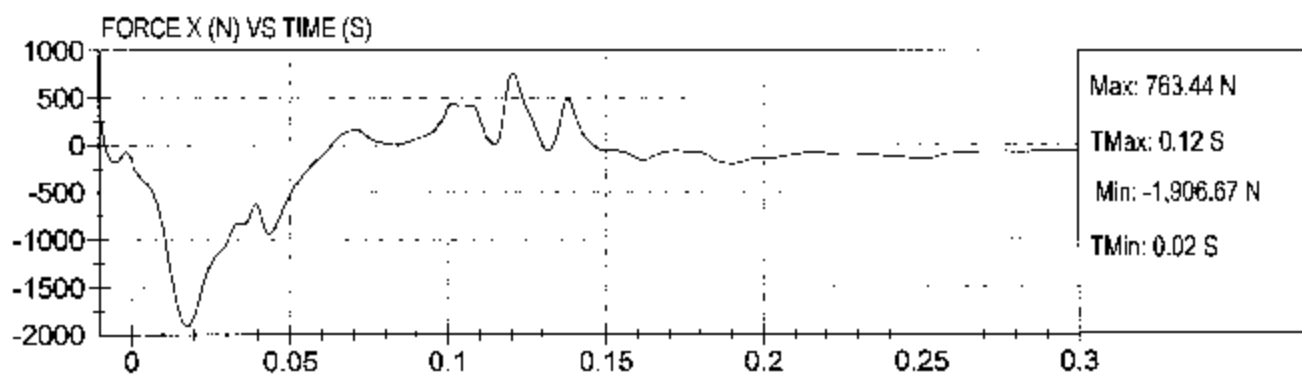
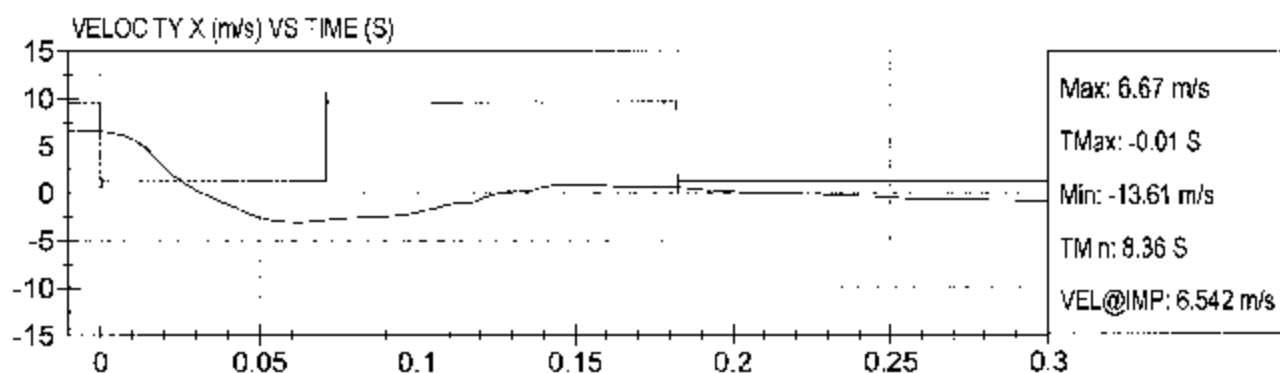
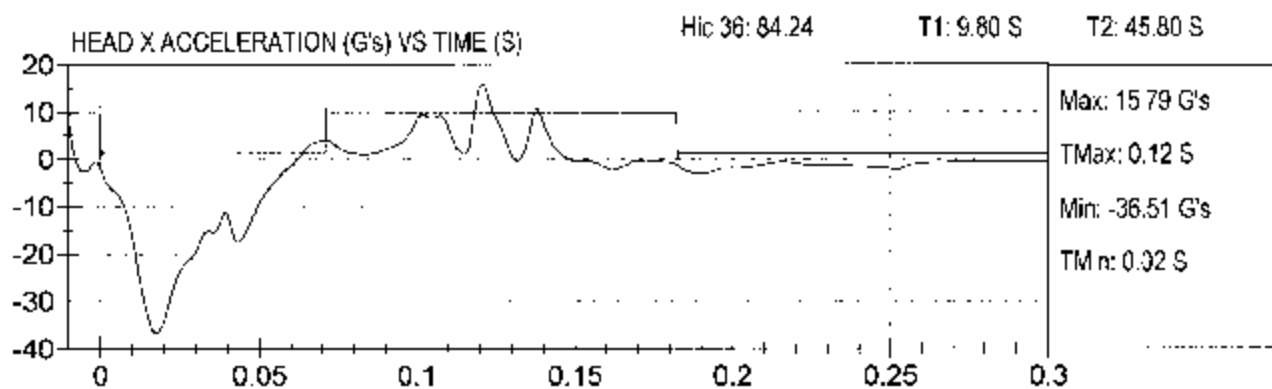
Test Date: 6/11/03
Location: H12





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

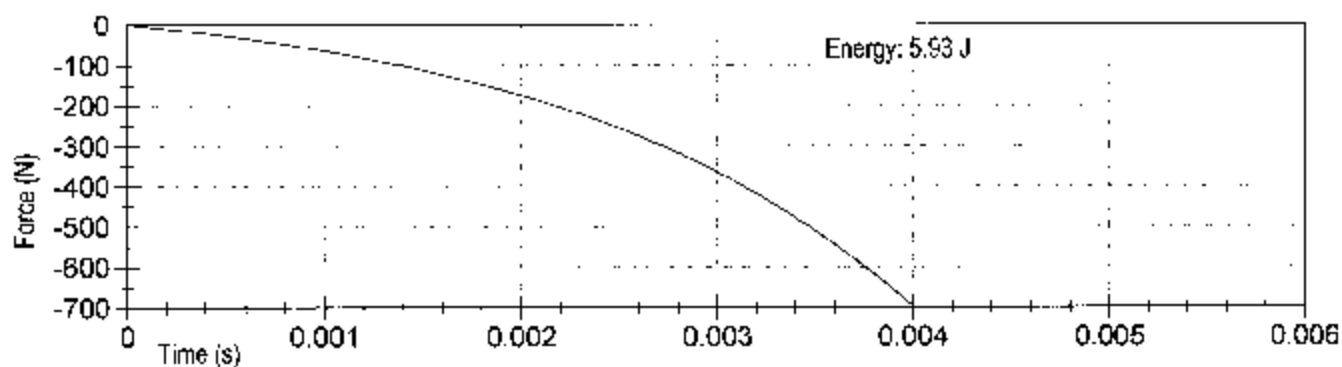
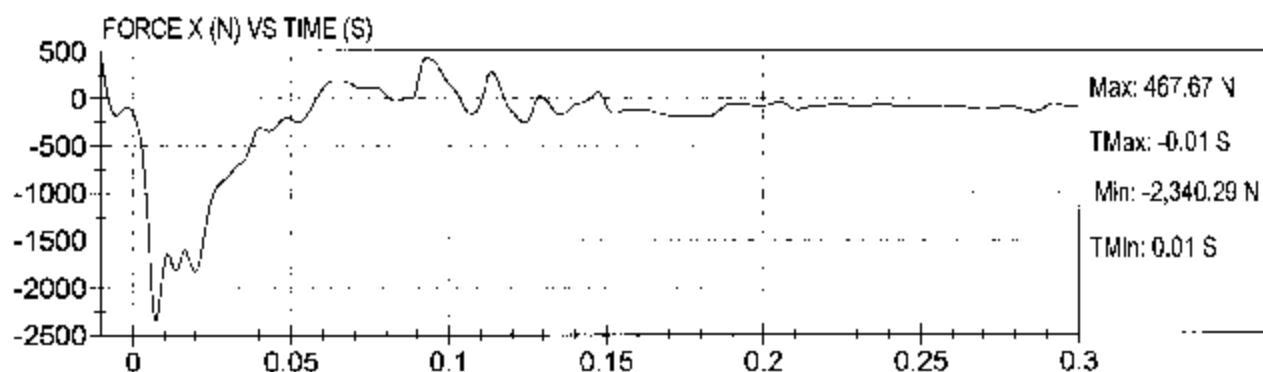
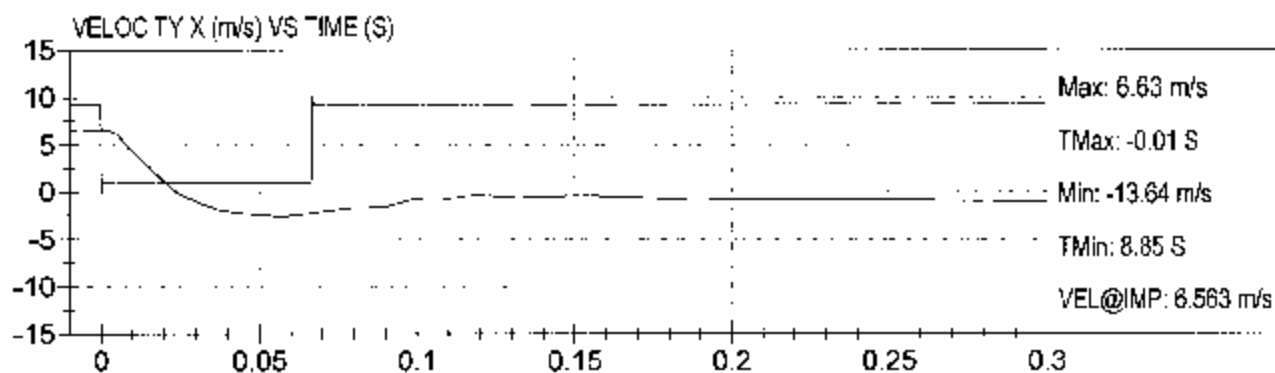
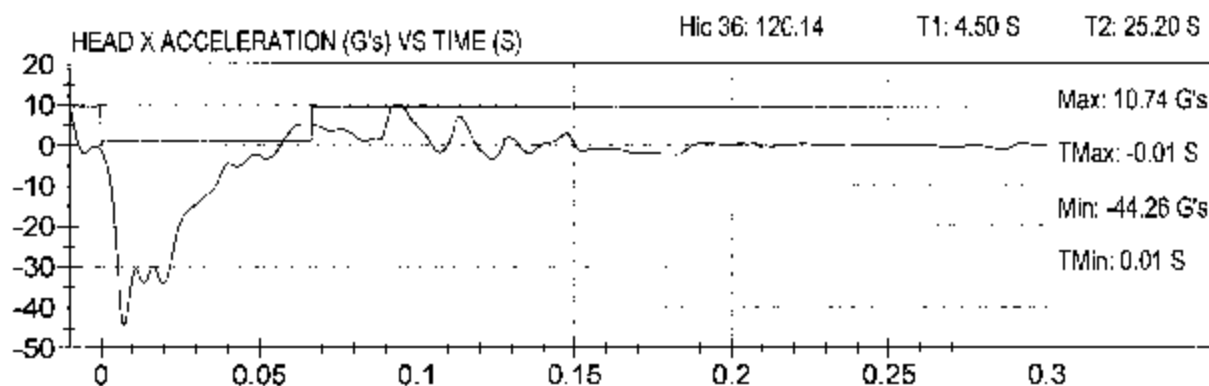
Test Date: 6/11/03
Location: H13





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

Test Date: 6/11/03
Location: H14





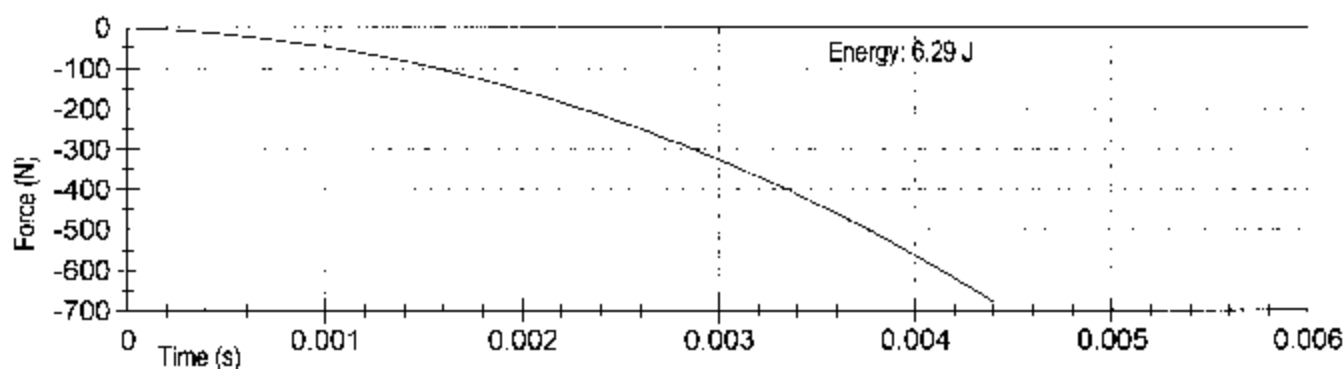
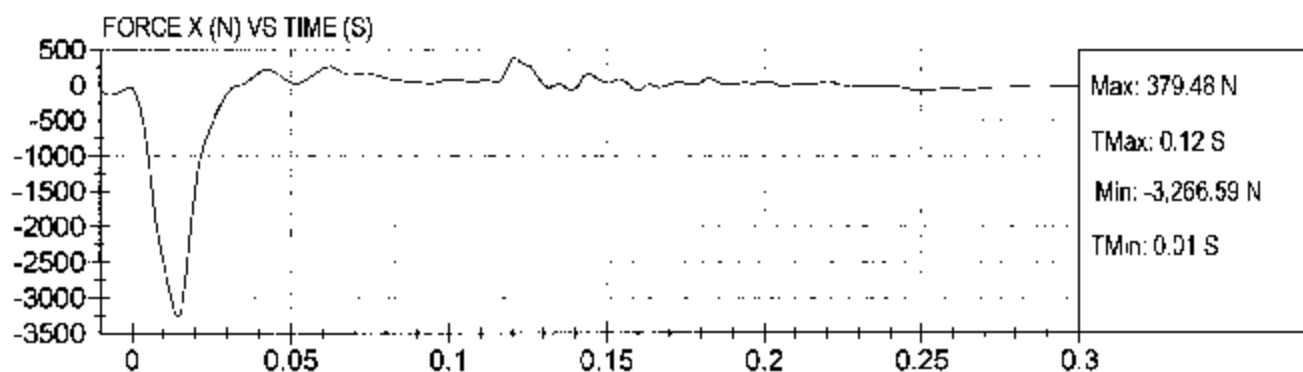
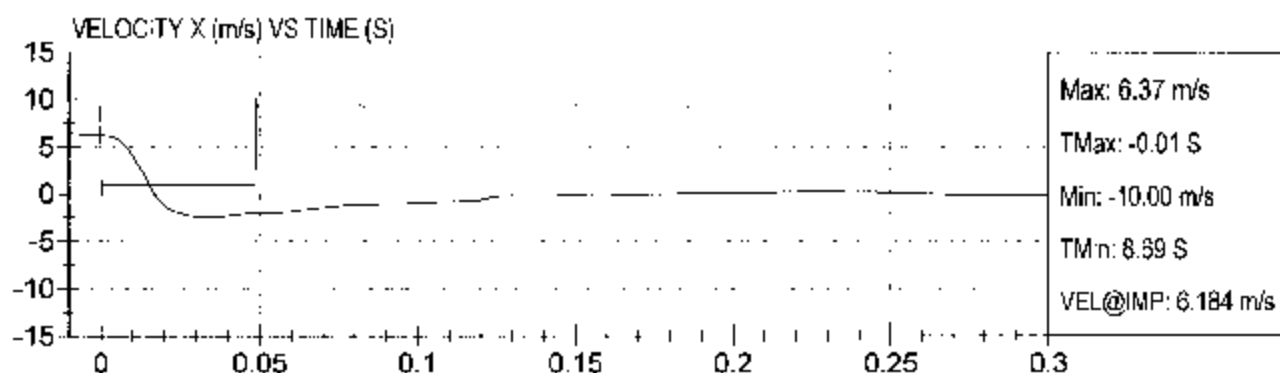
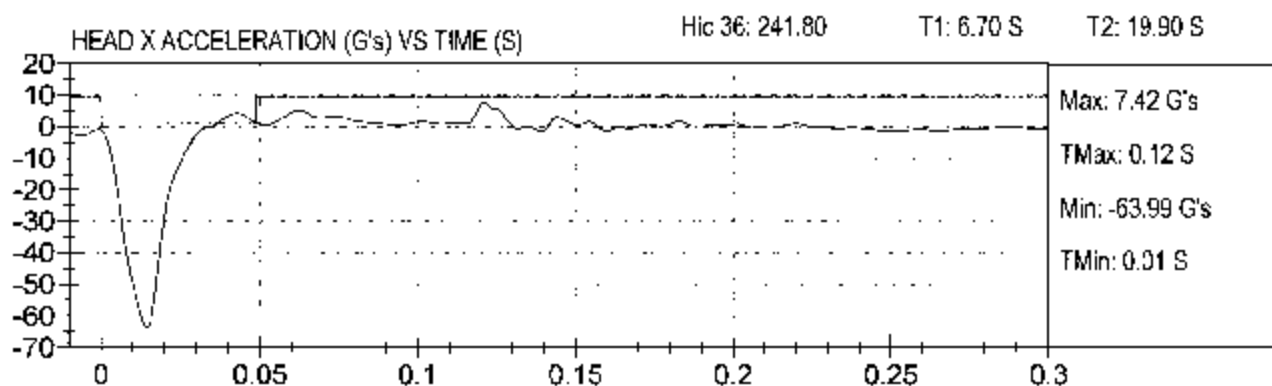
FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)

Vehicle: Mid Bus

NHTSA #: C30903

Test Date: 6/11/03

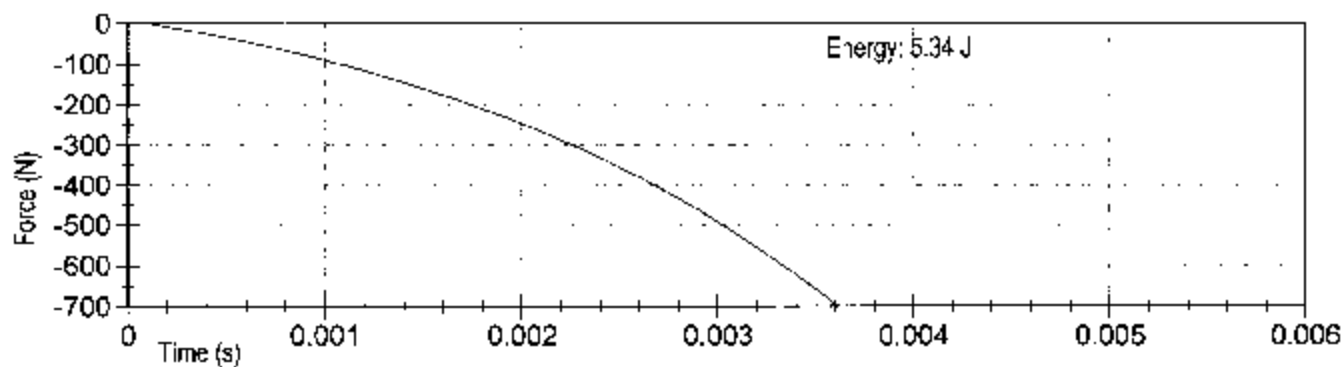
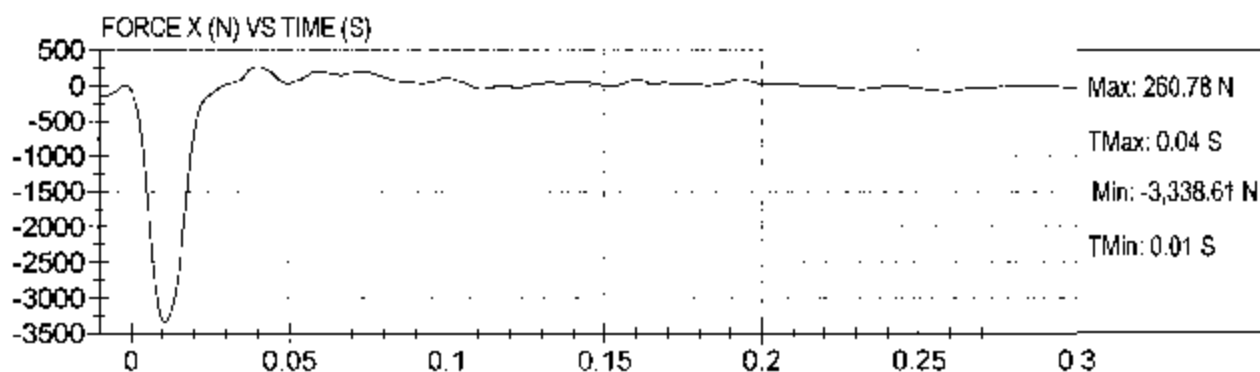
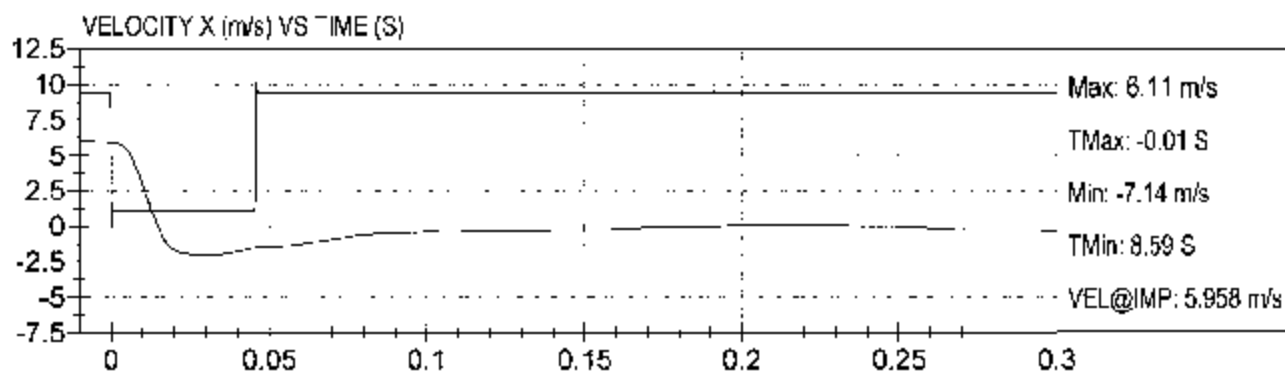
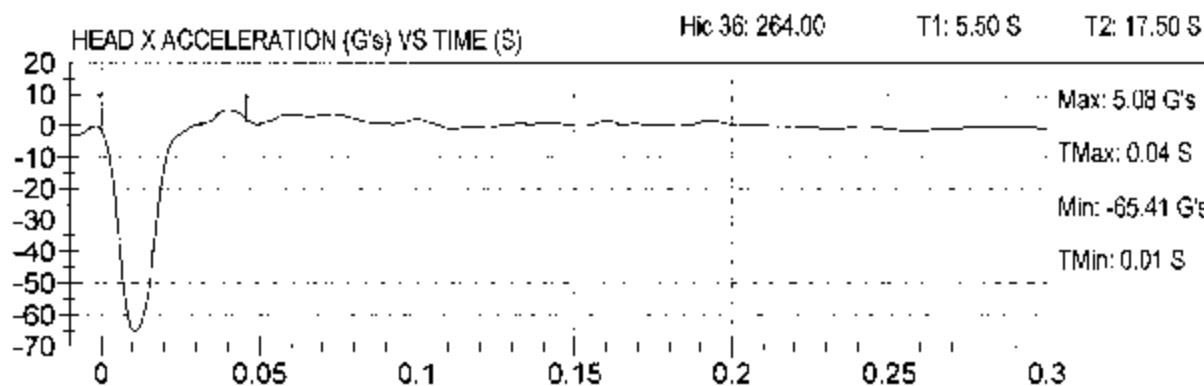
Location: H15





FMVSS 222 HEAD FORM IMPACTS (6.69 m/s)
Vehicle: Mid Bus
NHTSA #: C30903

Test Date: 6/11/03
Location: #16

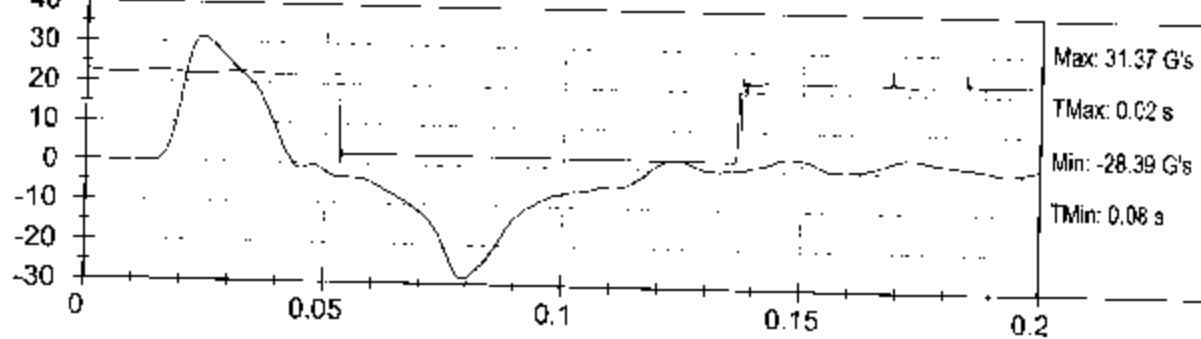




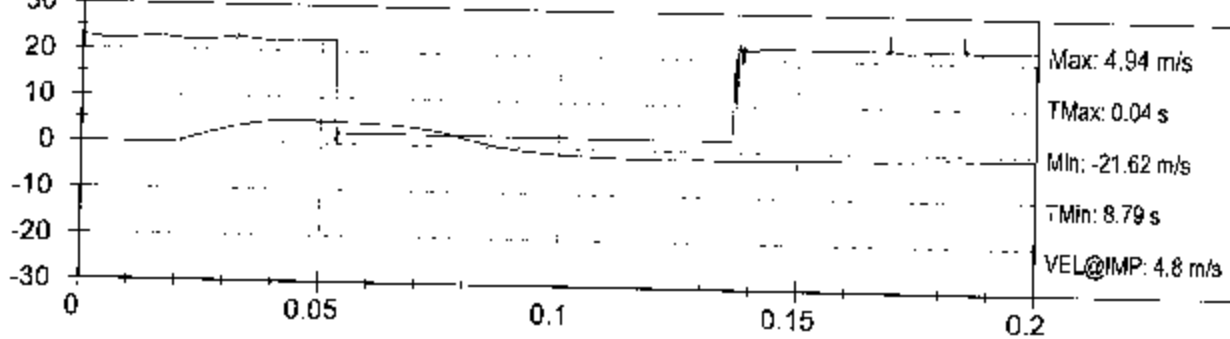
FMVSS 222 KNEE FORM IMPACTS
Vehicle: Mid-Bus
NHTSA #: C30603

Test Date: 6-20 03
Location: K1

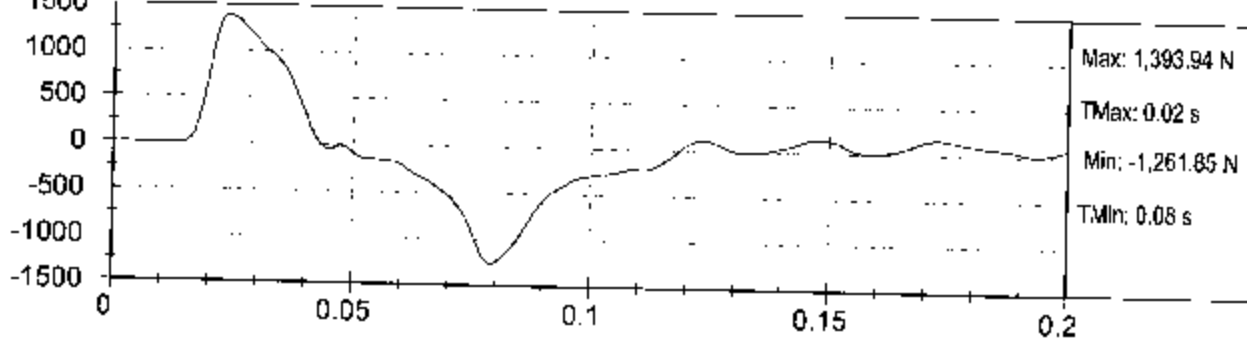
Knee X Acceleration (G's) VS TIME (S)



VELOCITY X (m/s) VS TIME (S)



FORCE X (N) VS TIME (S)





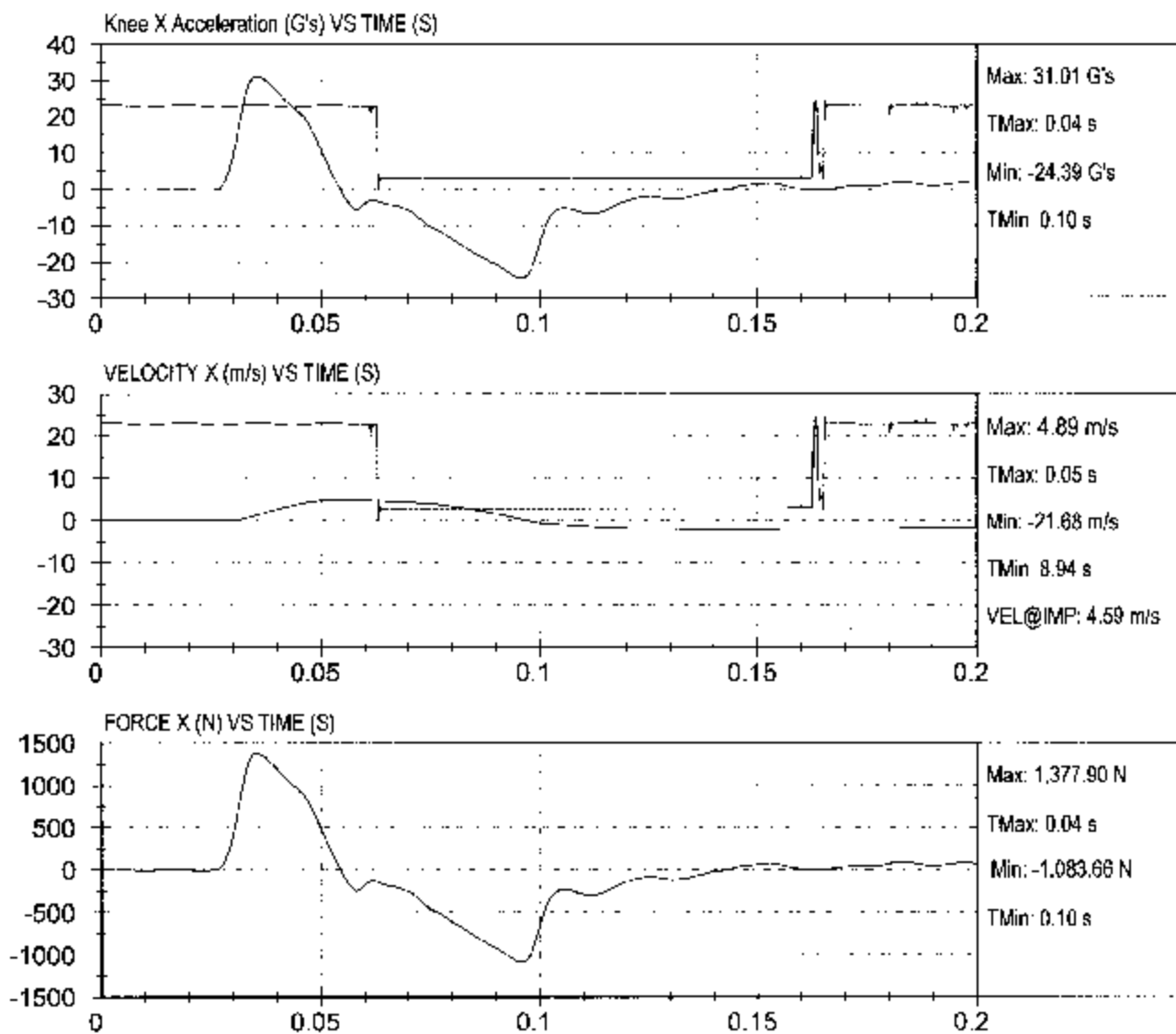
FMVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: C30903

Test Date: 6-20-03

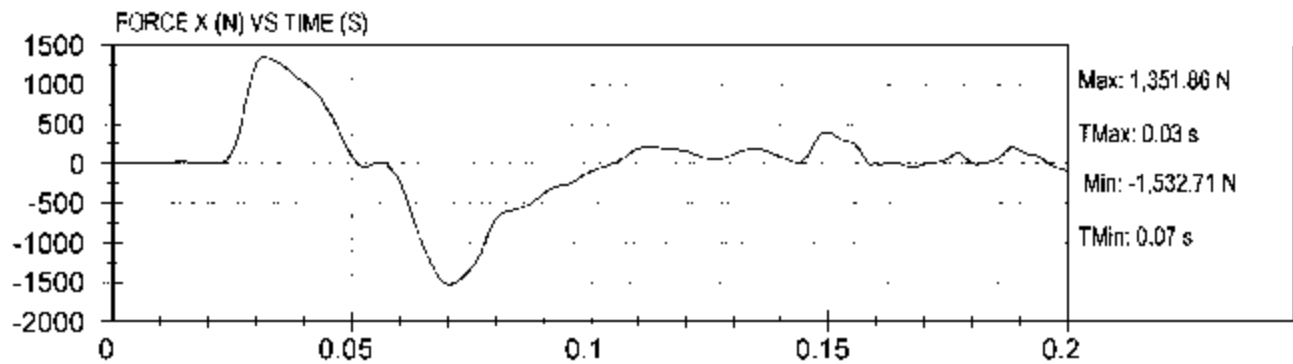
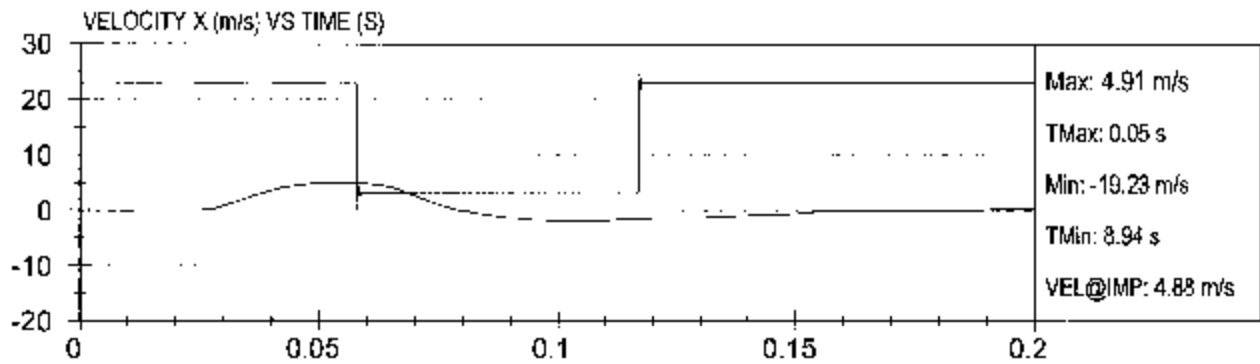
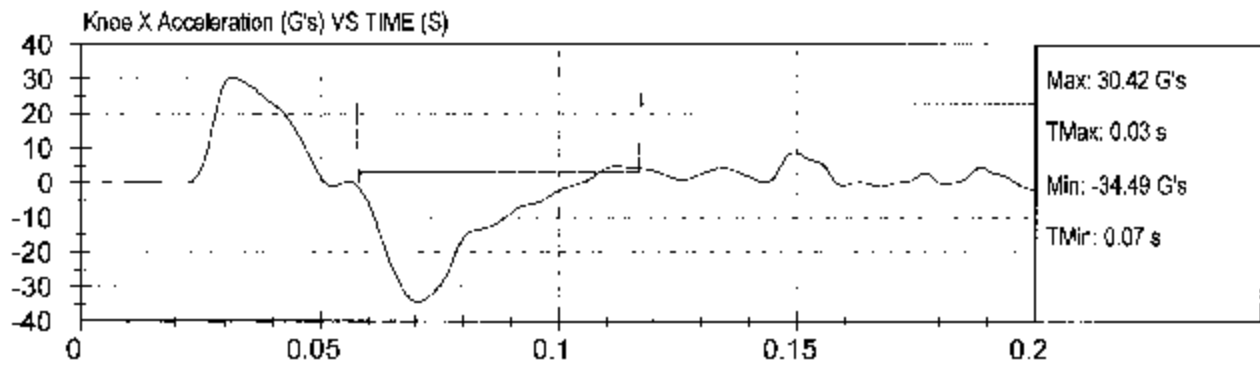
Location: K2





FMVSS 222 KNEE FORM IMPACTS
Vehicle: Mid-Bus
NHTSA #: C30903

Test Date: 6-20-03
Location: K3





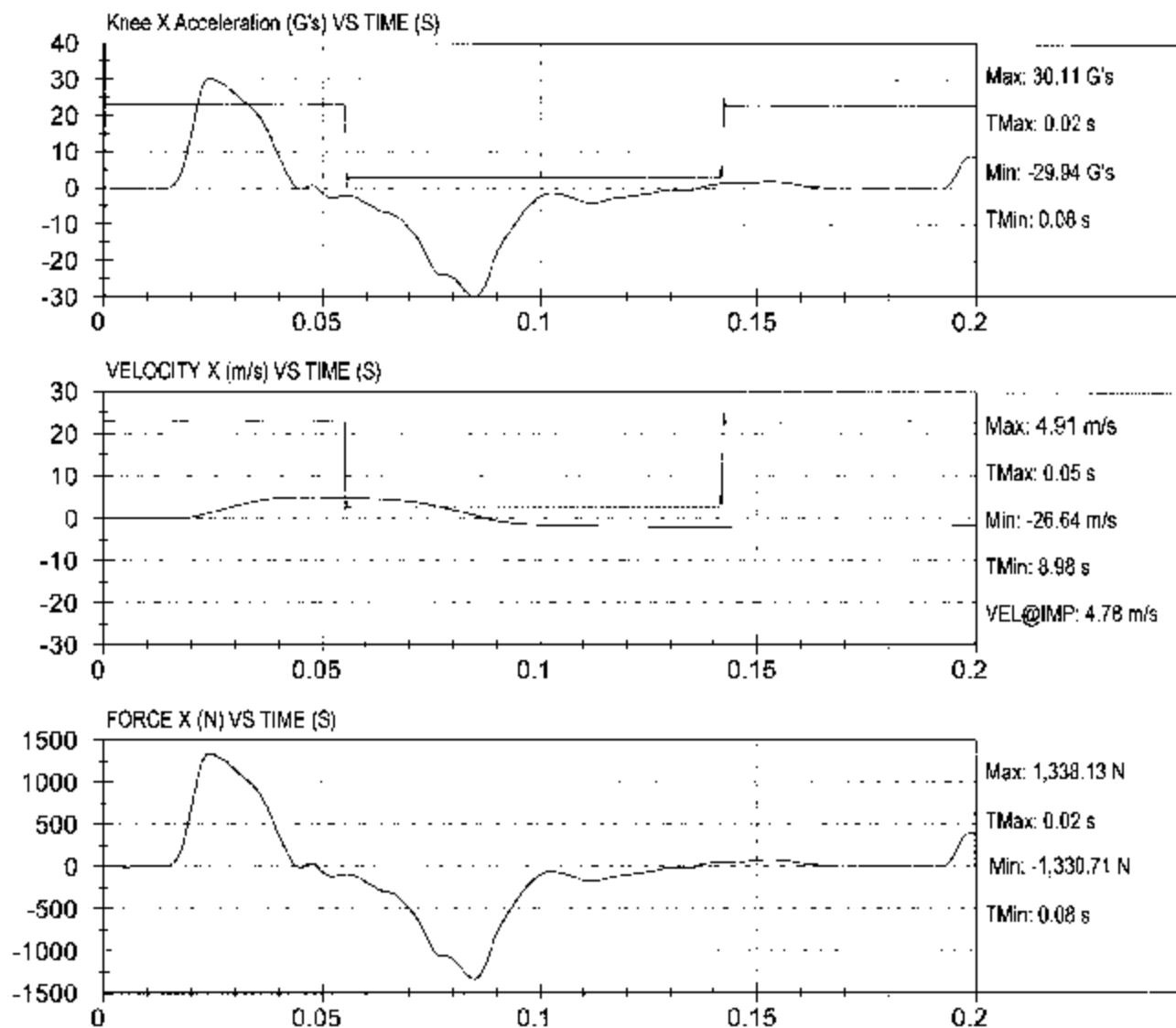
FMVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: C30903

Test Date: 6-20-03

Location: K4





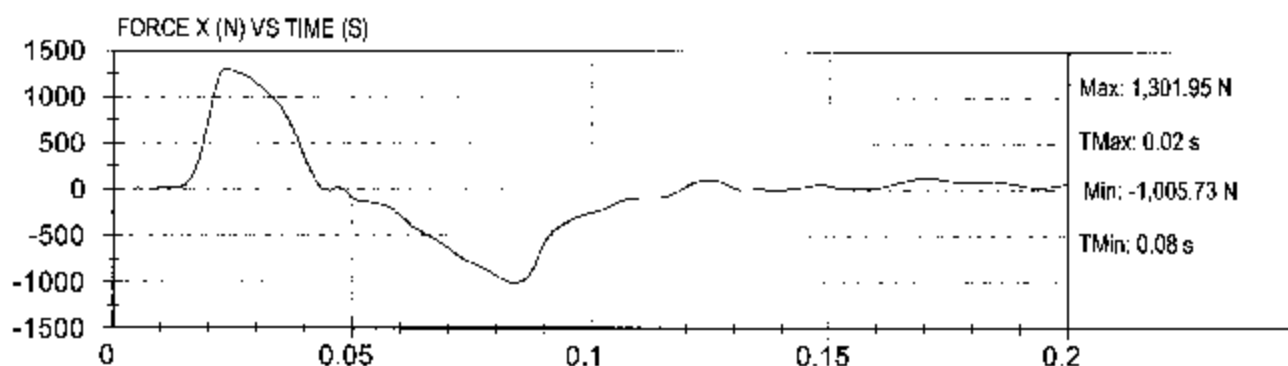
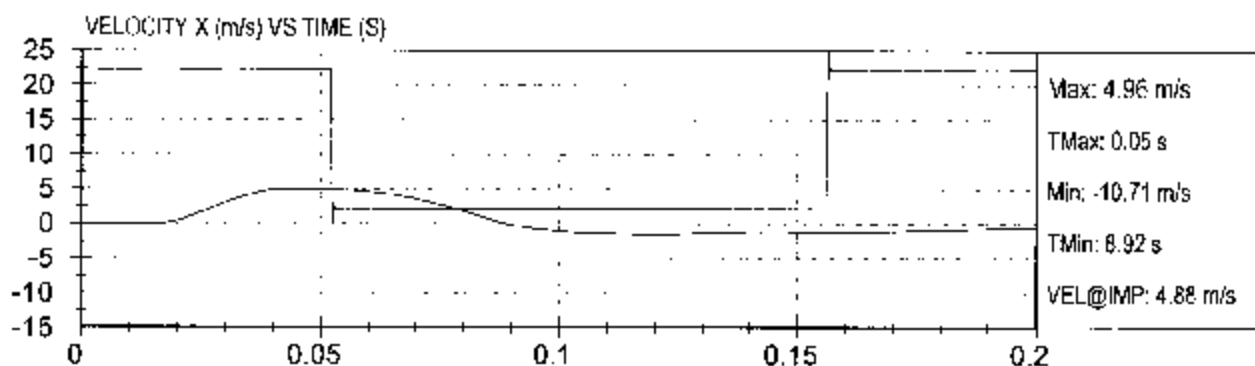
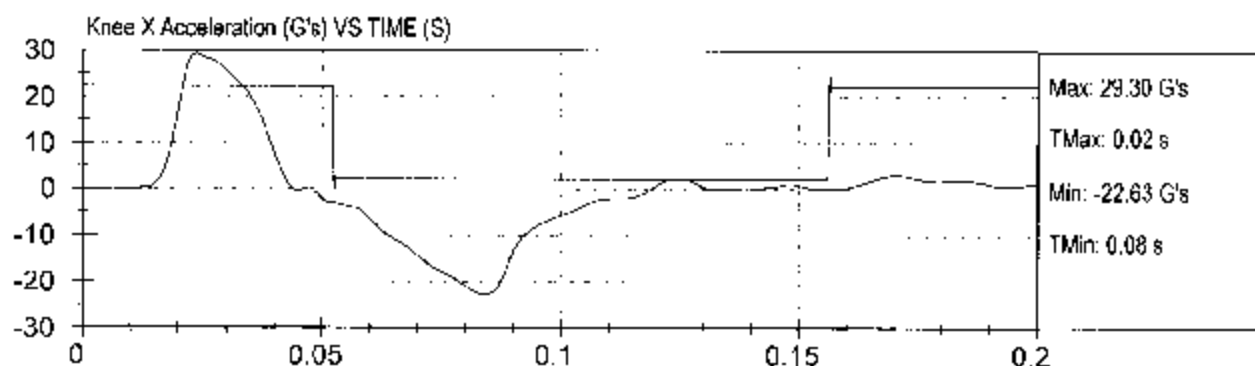
FMVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: G30903

Test Date: 6-20-03

Location: K5





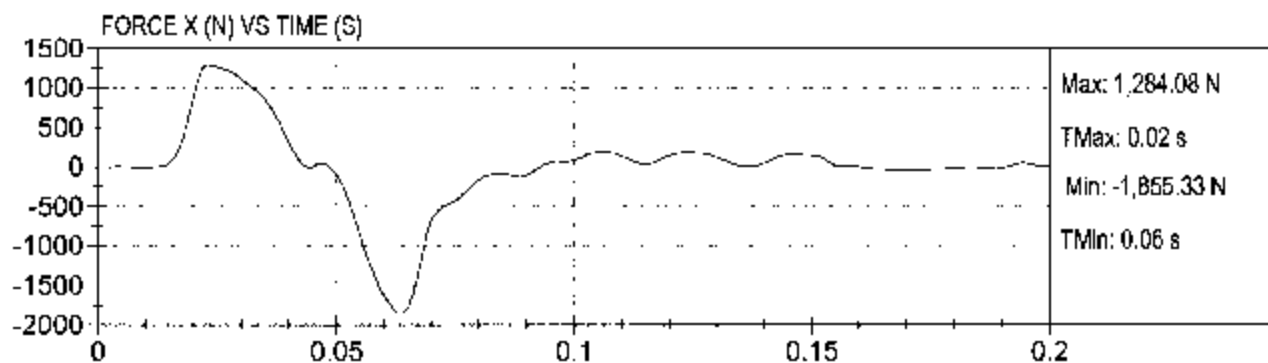
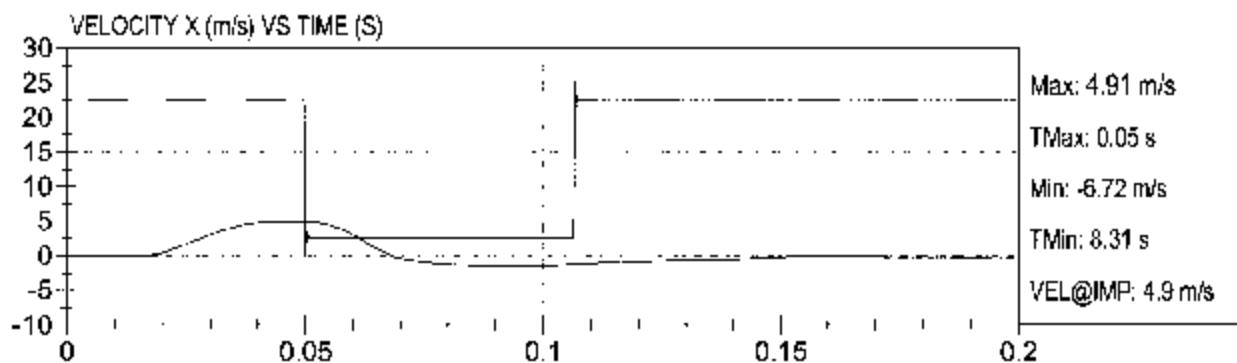
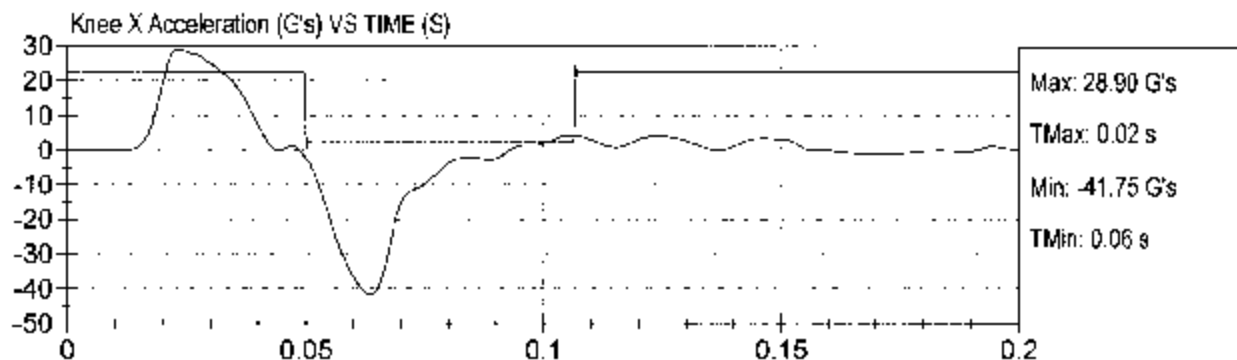
FWVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: C30903

Test Date: 6-20-03

Location: K6





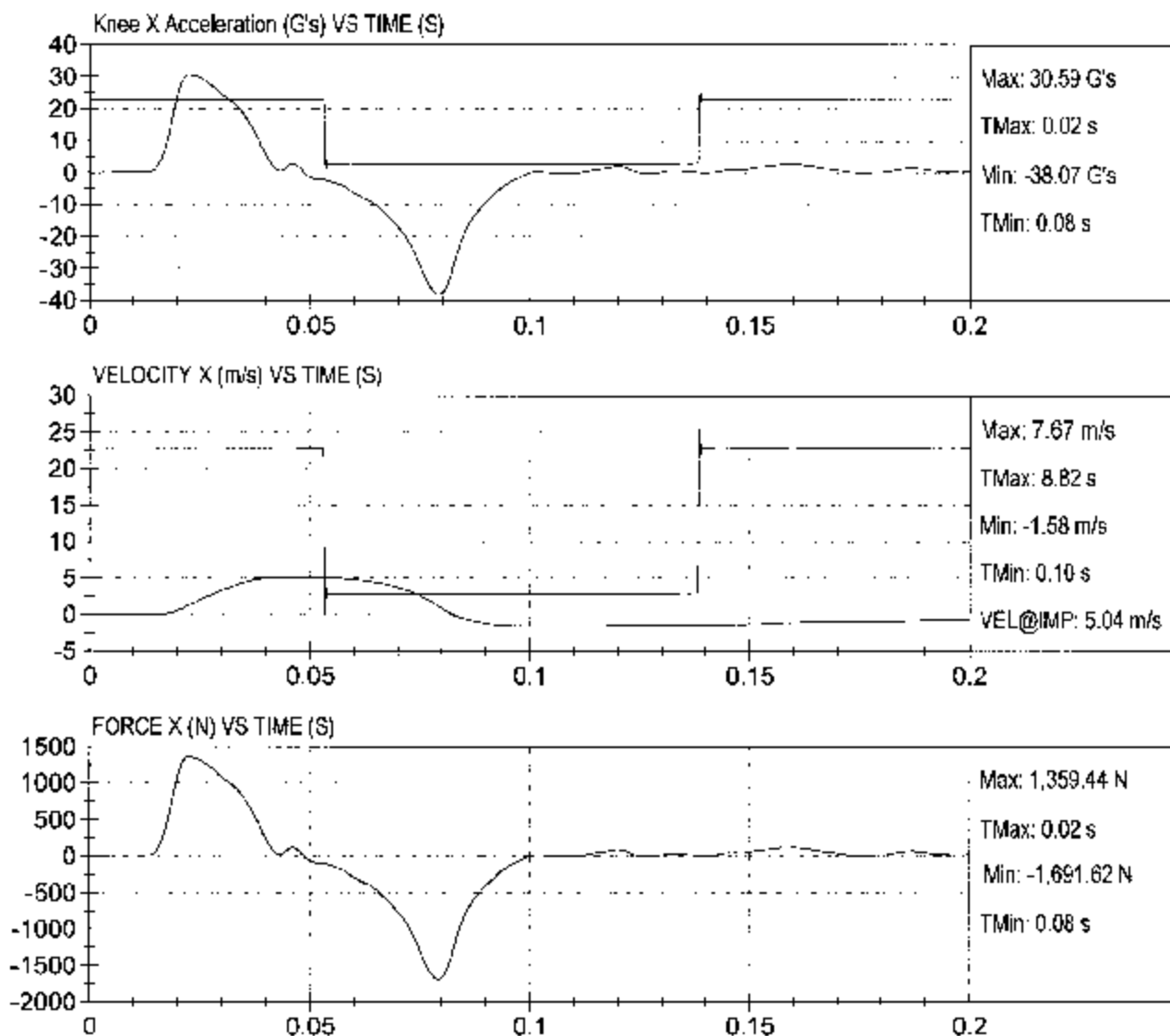
FMVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: C30903

Test Date: 6-20-03

Location: K7





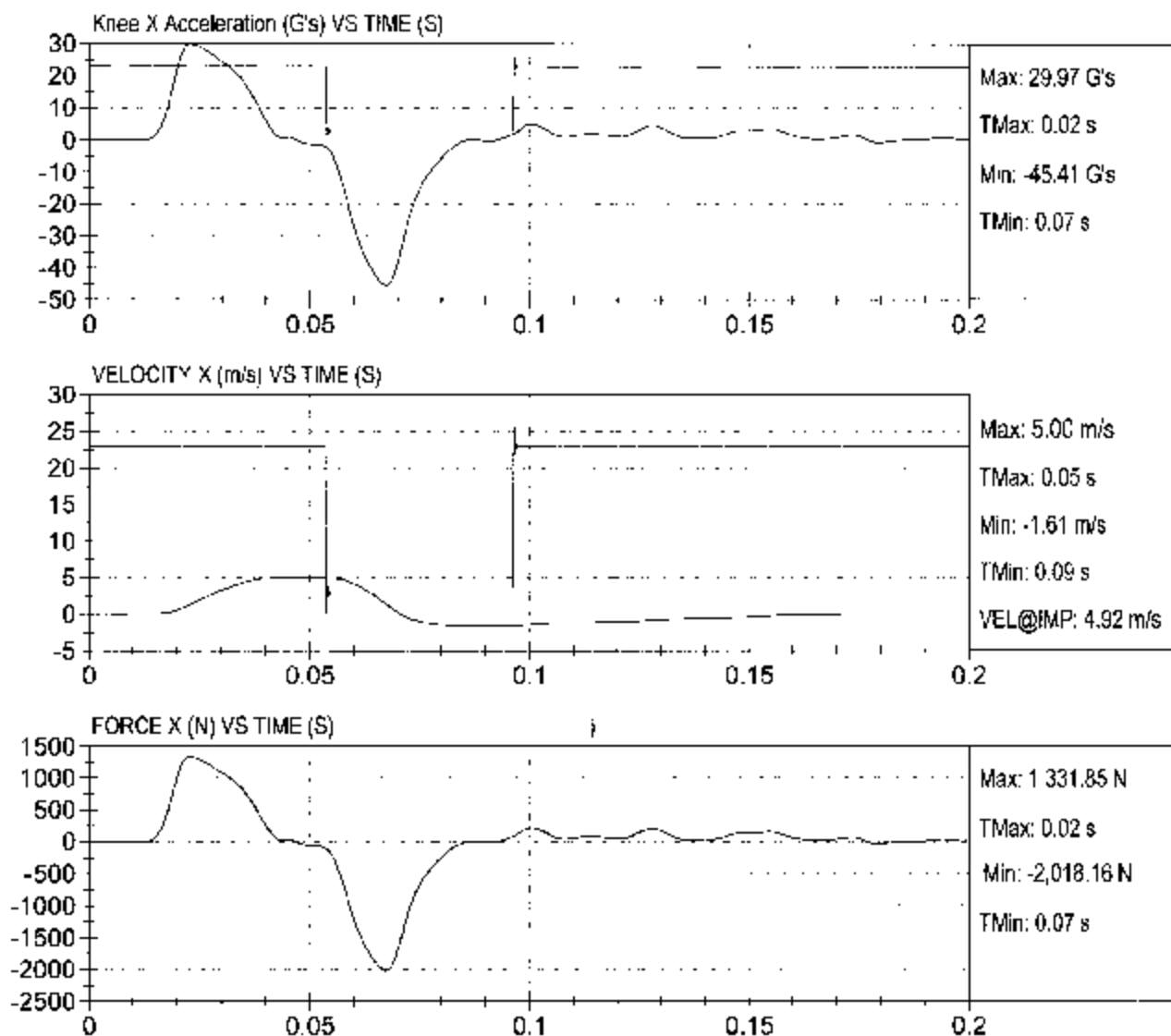
FMVSS 222 KNEE FORM IMPACTS

Vehicle: Mid-Bus

NHTSA #: C30903

Test Date: 6-20-03

Location: K8



Test Desc: W5 Left Rear Type C

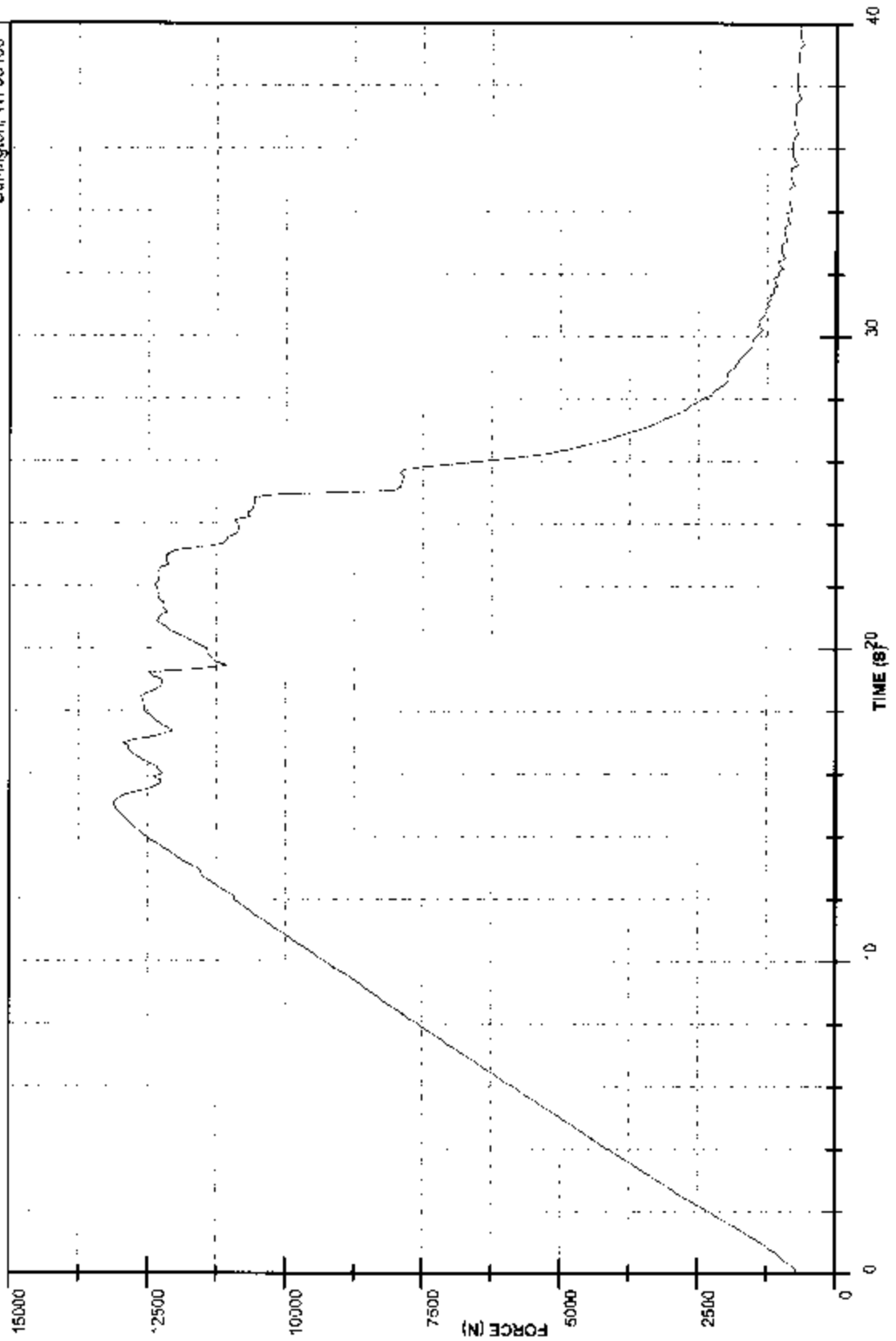
Test Date: 6-20-03

MGA Research Corp

Component ID: Mid Bus

NHTSA #: C30903

5000 Warren Road,
Burlington, WI 53105



Test Desc: W5 Type D Anchorage

Test Date: 6-24-03

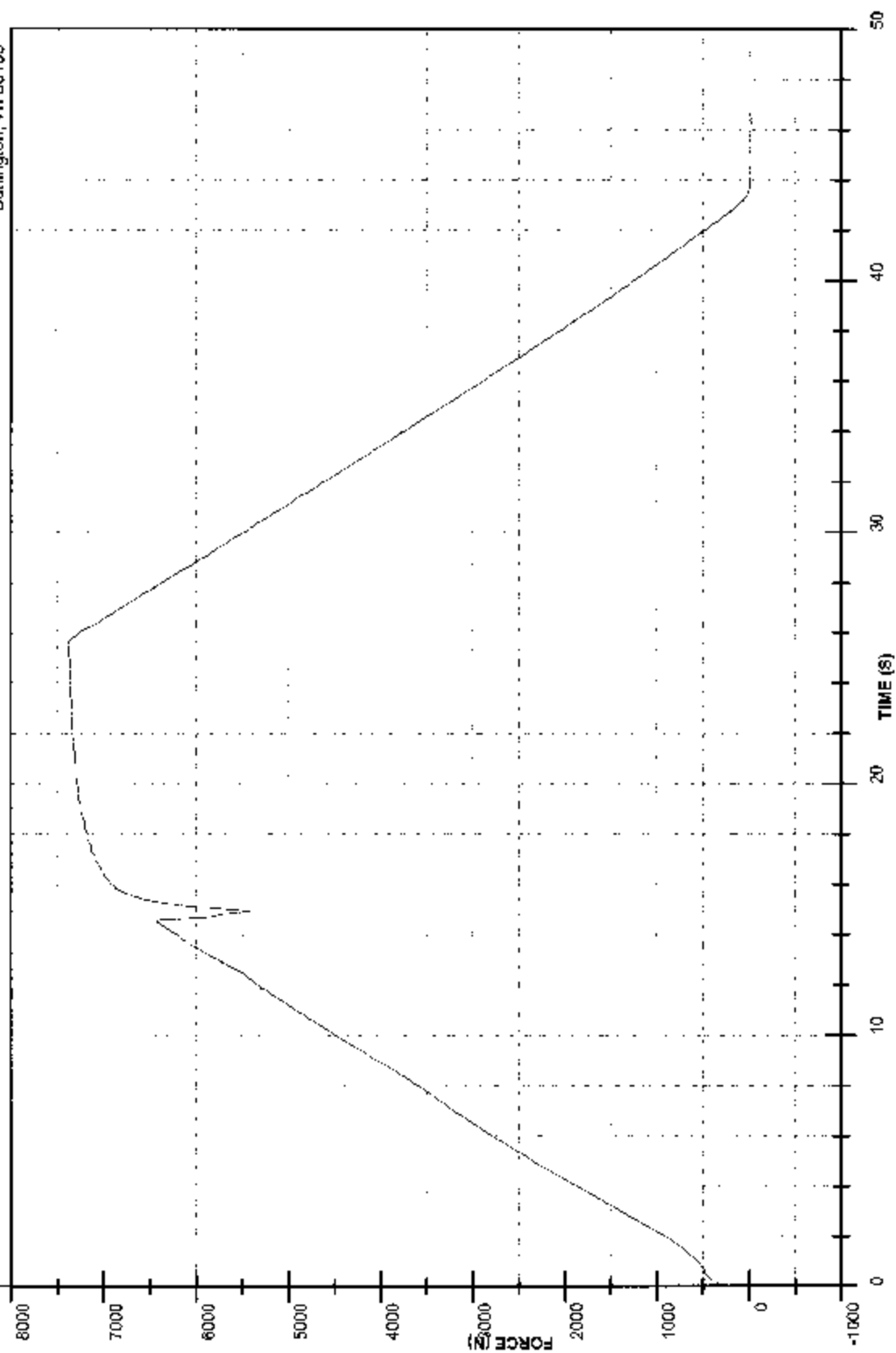
MGA Research Corp

Component ID: Mid Bus

NHTSA #: C30903

5000 Warren Road,

Burlington, WI 53105



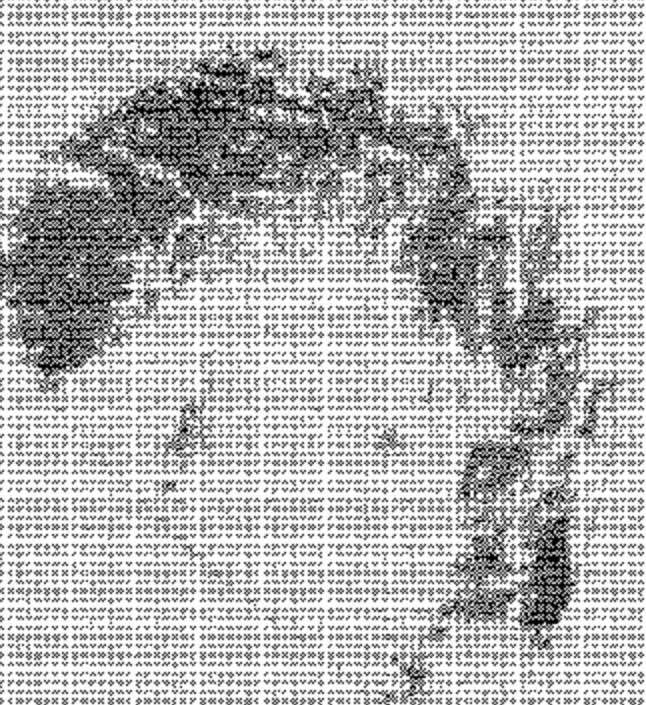
SECTION 7
WELT CONTACT POINTS

Test Vehicle: 2003 Mid-Bus Guide School Bus

Procedure: FMVSS 222

NHTSA No.: 020503

H1 / Seat S1



Test Vehicle: 2003 Mid Bus Guide School Bus

Procedure: FMVSS 222

NHTSA No.: C30903

H2 / Seat S1

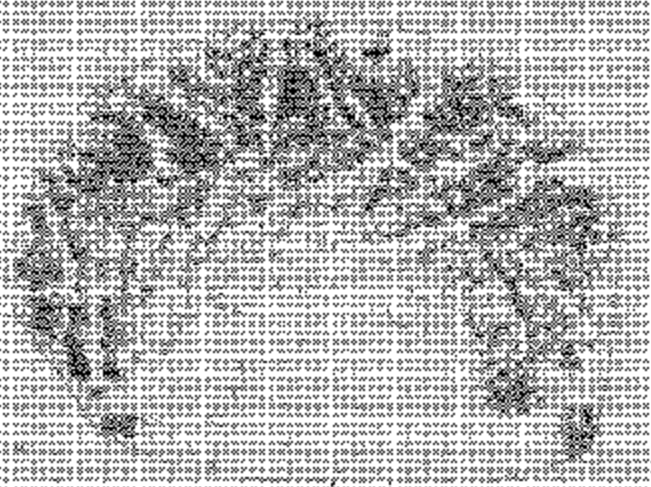


Test Vehicle: 2003 mid bus Glade School Bus

Procedure: FNYSS 322

NY TSA ID: C49903

H3 / Seat S1



Test Vehicle: 2003 Mid Bus Guido School Bus
Procedure: FMVSS 222

NHTSA No. C30903

H4 / Seat S1



Test Vehicle: 2003 Mid Bus Guide School Bus

Procedure: FMVSS 222

NIJ SA No.: D30903

H5 / Seat S1



Test Vehicle: 2003 Mid Bus Guide School Bus
Procedure: FMVSS 222

NHTSA No. C30905

HB / Seat S1



Test Vehicle: 2003 Mid Bus Grade School Bus

Procedure: FMVSS 222

NIJ IDA No. CQ0500

H7 / Seat S1

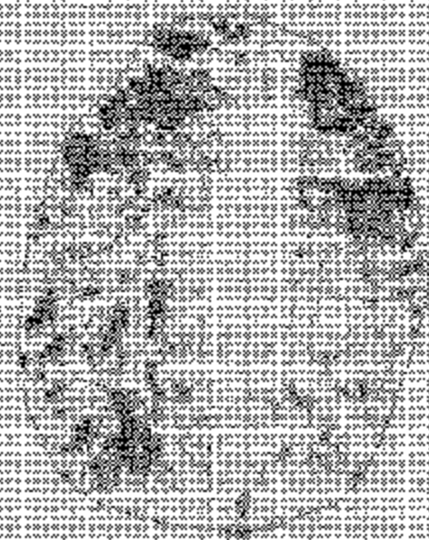


Test Vehicle: 2003 Mid Bus, Gulf Shores Bus

Fluxgates: FMVSS 222

NHTSA ID: C-10903

K1 / Seat S1



Test Vehicle: 2001 Mid Bus Guide School Bus
Procedure: FMVSS 222

NHTSA No. C30503

K2 / Seat S1

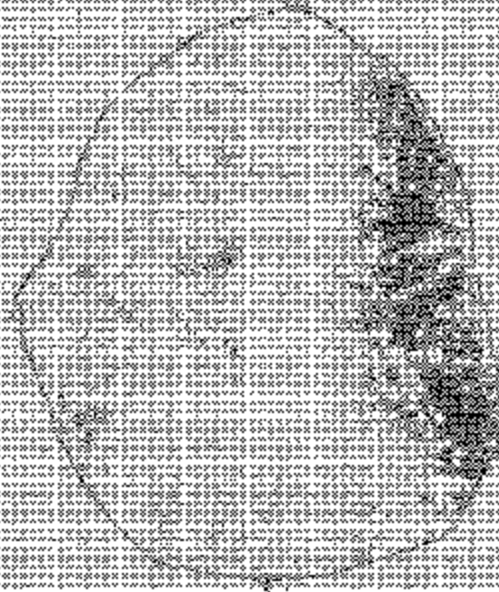


Test Vehicle: 2007 Mid Size Sedan School Bus

Procedure: FMVSS 224

NHTSA No: C30993

K3 / Seat S1



Test Vehicle: 2003 Mid Bus Guide School Bus

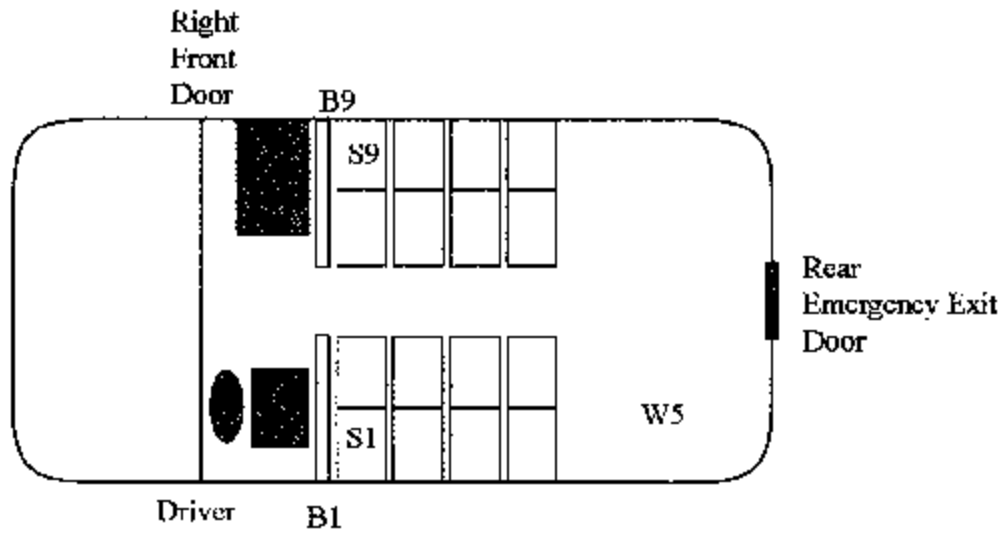
Procedure: FMVSS 222

MF-15A No. C30093

K4 / Seat S1



SECTION 8
BUS FLOOR PLAN



SECTION 9
LABORATORY NOTICE OF TEST FAILURE



LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure:	FMVSS 222	Test Date:	June 9, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.:	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

The forward projection of each seat back aft of each restraining barrier (as required in 49 CFR 571.222) falls outside the perimeter of the restraining barriers.

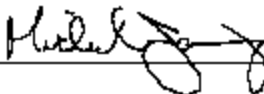
FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.2.2: "The position and rear surface area of the restraining barrier shall be such that, in a front projected view of the bus, each point of the barrier's perimeter coincides with or lies outside of the perimeter of the seat back of the seat for which it is required."

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 10, 2003

By: 



LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure	FMVSS 222	Test Date:	June 19, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.:	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

The forward deflection of the left side retraining barrier exceeded the maximum allowable force of 10,675 N before reaching the 356 mm displacement. Actual total force reached 14,091.9 N at 204 mm displacement. When the force vs. deflection data was plotted, it fell out of the specified corridor listed in 49 CFR 571.222 Figure 1. The test was stopped at 204 mm to avoid equipment damage. Also, two of the four floor mounting bolt were pulled up through the floor because no nuts were installed on them.

FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.2.3(a): "The restraining barrier force/deflection curve shall fall within the zone specified in Figure 1."

Paragraph S.5.2.3(d): "The restraining barrier shall not separate from the vehicle at any attachment point; and

(e) "Restraining barrier components shall not separate from the vehicle at any attachment point.

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 23, 2003

By: Michael Janovicz



LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure:	FMVSS 222	Test Date:	June 17, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.:	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

The plotted force vs. deflection data from the forward deflection of the Right side retraining barrier failed to remain within the specified corridor found in 49 CFR 571.222 Figure 1.

FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.2.3(a): "The restraining barrier force/deflection curve shall fall within the zone specified in Figure 1."

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 23, 2003

By: Michael Janovicz



10/20/03 10:00 AM

LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure	FMVSS 222	Test Date:	June 20, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.:	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

The force application to the left rear wheelchair anchorage point (Type A,B) in the W5 location did not reach the specified force before the failure of the floor structure. The force requirement as specified in 49 CFR 571.222 is 26,688 N. The actual force reached 13104 N before failure of the floor structure.

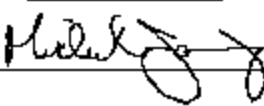
FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.4.1.3: "Each wheelchair securement anchorage shall be capable of withstanding a force of 13,344 Newtons ..." "When more than one securement device share a common anchorage, the anchorage shall be capable of withstanding a force of 13,344 Newtons multiplied by the number of securement devices sharing that anchorage."

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 23, 2003

By: 



Test Procedure:	FMVSS 222	Test Date:	June 11, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.:	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

Seat S9 failed to meet energy requirement of 1356 joules when deflected 356 mm as described in 49 CFR 571.222. The actual energy totaled 1304.6 joules.

FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.1.3.4: "Apply an additional force horizontally in the forward direction until 452W joules of energy have been absorbed in deflecting the seat back (or restraining barrier)."

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 17, 2003

Bv:

Phelan



Page 1 of 1

LABORATORY NOTICE OF TEST FAILURE TO OVSC

Test Procedure:	FMVSS 222	Test Date:	June 13, 2003
Test Vehicle:	2003 Mid Bus Guide	Test Lab:	MGA Research Corp.
NHTSA No.	C30903	Project Engineer:	Michael Janovicz
Contract No.:	DTNH22-02-D-01057	Delivery Order No.:	Contract
MFR.:	Mid Bus	VIN:	1GBJG31U431110295
Build Date:	12/02		

TEST FAILURE DESCRIPTION

Seat S3 failed to meet energy requirement of 948 joules when deflected 254 mm as described in 49 CFR 571.222. The actual energy totaled 837.6 joules.

FMVSS REQUIREMENTS DESCRIPTION

Paragraph S.5.1.4.2: "Apply an additional force horizontally rearward through the loading bar until 316W joules of energy have been absorbed in deflecting the seat back."

Remarks: No remarks.

Notification to NHTSA (COTR): Brian Smith

Date: June 17, 2003

By: Michael Janovicz